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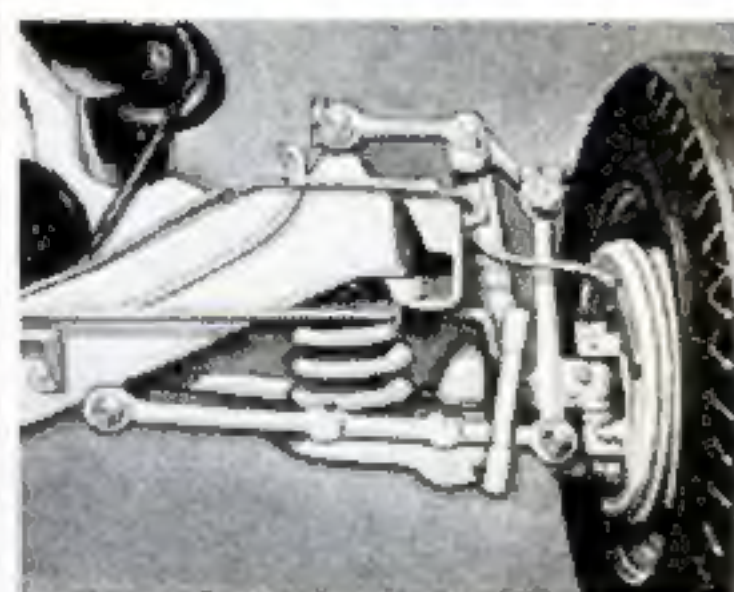
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next month . . .

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<input type="checkbox"/> Architect <input type="checkbox"/> Architectural Draftsman <input type="checkbox"/> Building Estimating <input type="checkbox"/> Contractor and Builder <input type="checkbox"/> Structural Draftsman <input type="checkbox"/> Structural Engineer <input type="checkbox"/> Management of Inventions <input type="checkbox"/> Electrical Engineer <input type="checkbox"/> Electric Lighting <input type="checkbox"/> Welding, Electric and Gas <input type="checkbox"/> Reading Shop Blueprints <input type="checkbox"/> Heat Treatment of Metals	<input type="checkbox"/> Sheet Metal Worker <input type="checkbox"/> Boilermaker <input type="checkbox"/> Telegraph Engineer <input type="checkbox"/> Telephone Work <input type="checkbox"/> Radio <input type="checkbox"/> Mechanical Engineering <input type="checkbox"/> Mechanical Draftsman <input type="checkbox"/> Machinist <input type="checkbox"/> Toolmaker <input type="checkbox"/> Patternmaker <input type="checkbox"/> Diesel Engines <input type="checkbox"/> Aviation Engines <input type="checkbox"/> Auto Technician <input type="checkbox"/> Auto Electrical Technician	<input type="checkbox"/> Commercial Refrigeration <input type="checkbox"/> Plumbing <input type="checkbox"/> Steam Fitting <input type="checkbox"/> Heating <input type="checkbox"/> Ventilation <input type="checkbox"/> Air Conditioning and Cooling <input type="checkbox"/> Steam Engineer <input type="checkbox"/> Steam Electric Engineer <input type="checkbox"/> Marine Engineer <input type="checkbox"/> R. R. Locomotives <input type="checkbox"/> R. R. Section Foreman <input type="checkbox"/> Air Brakes <input type="checkbox"/> R. R. Signalmen <input type="checkbox"/> Highway Engineering <input type="checkbox"/> Civil Engineering	<input type="checkbox"/> Surveying and Mapping <input type="checkbox"/> Bridge Engineer <input type="checkbox"/> Bridge and Building Foreman <input type="checkbox"/> Chemistry <input type="checkbox"/> Pharmacy <input type="checkbox"/> Coal Mining <input type="checkbox"/> Mine Foreman <input type="checkbox"/> Fire Houses <input type="checkbox"/> Navigation <input type="checkbox"/> Cotton Manufacturing <input type="checkbox"/> Woolen Manufacturing <input type="checkbox"/> Agriculture <input type="checkbox"/> Fruit Growing <input type="checkbox"/> Poultry Farming
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<p align="center">DOMESTIC SCIENCE COURSES</p>			
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\$30, \$50, \$75 A WEEK

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The man who has directed the home study training of more men for the Radio Industry than any other man in America.

HERE'S PROOF THAT MY TRAINING PAYS



Chief Operator Broadcasting Station
"When I completed 20 lessons, I obtained my Radio Broadcast Operator's license and immediately joined Station WMLC where I am now Chief Operator." **HOLLIS F. HAYES**, 87 Madison St., LaPorte, Mich.

\$10 a Week in Spare Time

"My work has consisted of Radio set servicing, with some Public Address Systems work—all in my spare time. My earnings in Radio amount to about \$10 a week."—**WILLIAM MEYER**, 705 Ridge Road, Hobart, Ind.



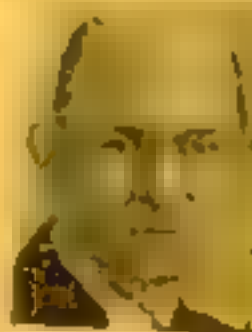
Over \$1,000 Before Graduating

"Before completing half the N. R. I. Course I was servicing sets and I made \$1,000 to \$1,200 before graduating. I am now doing Radio service work for myself."—**ASHLEY G. ALDRIDGE**, 1224 Shepherd St., Petersburg, Va.



\$200 to \$300 a Month in Own Business

"For the last 18 months I have been in business for myself, making between \$200 and \$300 a month. I have N. R. I. to thank for my start in this field." **ARLIE J. FROEHNER**, 224 W. Texas Ave., Goose Creek, Texas.



Serviceman for Three Stores

"Along with my own work I am handling service work for three Radio stores. I think this is good. Most of the plants here have been closed, few people are working." **WILLIAM MOSTELLER**, 739 E. 3rd St., Williamsport, Pa.



Radio offers you many opportunities for well-paying spare time and full time jobs. You don't have to give up your present job, leave home or spend a lot of money to become a Radio Expert. I'm so sure I can train you at home for a good Radio job that I agree in writing to refund every penny you pay me if you are not satisfied with my training when you finish.

Get Ready Now for Jobs Like These

Radio broadcasting stations employ engineers, operators, station managers and pay up to \$5,000 a year. Fixing Radio sets in spare time pays many \$200 to \$500 a year—full time jobs with Radio jobbers, manufacturers and dealers as much as \$30, \$50, \$75 a week. Many Radio Experts open full or part time Radio sales and repair businesses. Radio manufacturers and jobbers employ testers, inspectors, foremen, engineers, servicemen, and pay up to \$6,000 a year. Automobile, police, aviation, commercial Radio, loud speaker systems and newer fields offering good opportunities now and for the future. Television promises to open many good jobs soon. Men I trained have good jobs in these branches of Radio. Read how they got their jobs. Mail coupon.

Why Many Radio Experts Make \$30, \$50, \$75 a Week

Radio is young—yet it's one of our large industries. More than 28,000,000 homes have one or more Radios. There are more Radios than telephones. Every year millions of Radios get out of date and are replaced. Millions more need new tubes, repairs. Over \$50,000,000 are spent every year for Radio repairs alone. Over 5,000,000 auto Radios are in use; more are being sold every day, offering more profit-making opportunities for Radio experts. And RADIO IS STILL YOUNG, GROWING, expanding into new fields. The few hundred \$30, \$50, \$75 a week jobs of 20 years ago have grown to thousands. Yes, Radio offers opportunities—now and for the future!

Many Make \$5, \$10, \$15 a Week Extra in Spare Time While Learning

The day you enroll, in addition to our regular Course, I start sending Extra Money Job Sheets, show you how to do Radio repair jobs. Throughout your training I send plans and directions that made good spare time money—\$200 to \$500—for hundreds, while learning. I send you special Radio equipment to conduct experiments, build circuits. This 50-50 method of training makes learning at home easy, fascinating, practical.

THE TESTED WAY TO

EXPERT



SET SERVICING. Spare time set servicing pays many \$5, \$10, \$15 a week extra while learning. Full time servicing pays as much as \$30, \$50, \$75 a week

I Also Give You This Professional Servicing Instrument

Here is the instrument every Radio expert needs and wants—an All-Wave, All-Purpose, Set Servicing Instrument. It contains everything necessary to measure A.C. and D.C. voltages and current; to test tubes, resistance; adjust and align any set, old or new. It satisfies your needs for professional servicing after you graduate—can help you make extra money fixing sets while training.



Find Out What Radio Offers You

Act Today. Mail the coupon now for "Rich Rewards in Radio." It's free to any fellow over 16 years old. It points out Radio's spare time and full time opportunities and those coming in Television; tells about my training in Radio and Television; shows you letters from men I trained, telling what they are doing and earning. Find out what Radio offers YOU! MAIL COUPON in an envelope, or paste on a post-card—NOW!

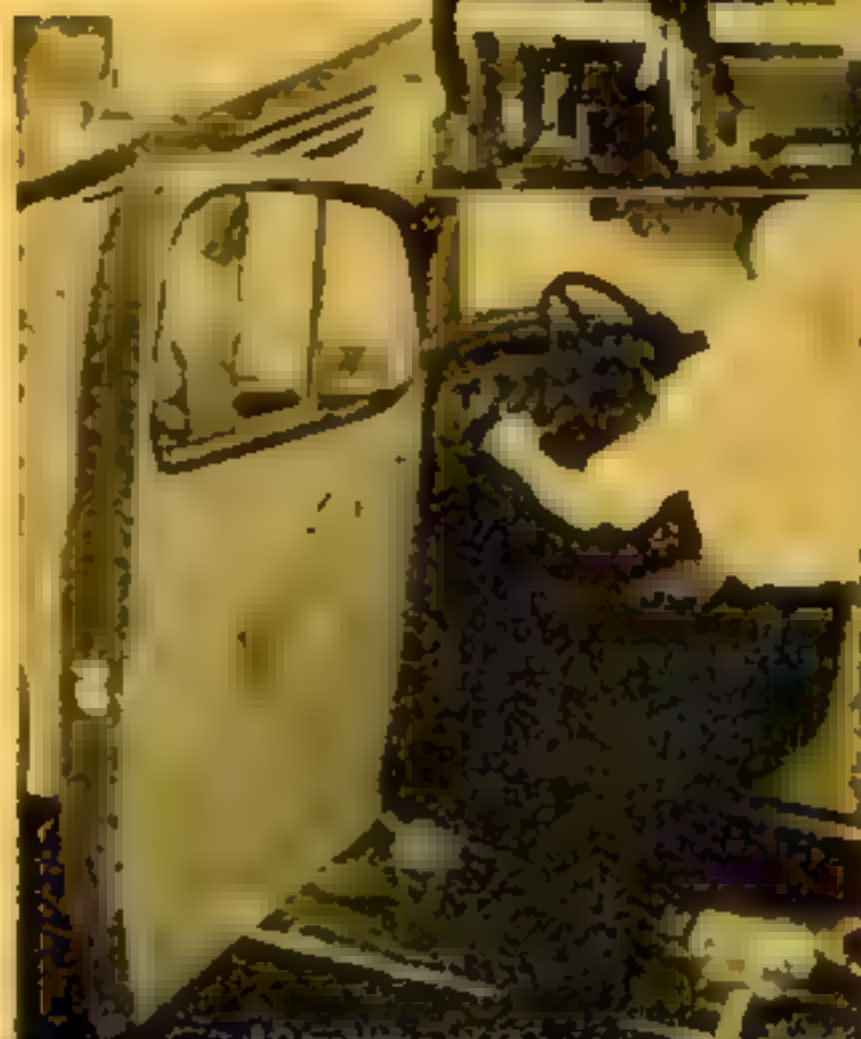
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Dear Mr. Smith: Without obligating me, send "Rich Rewards in Radio," which points out the spare time and full time opportunities in Radio and explains your 50-50 method of training men at home in spare time to become Radio Experts. (Please Write Plainly.)

NAME AGE.....

ADDRESS.....

CITY STATE.....

Our Readers Say

Raking Them Over the Coals Is the American Way

You have to give that fellow Mussolini credit—he does have some good ideas. That stunt of making government officials jump through fire and over fences of bayonets is one of the greatest pieces of statesmanship that I have heard about lately. I think a little bayonet-diving would be a fine thing for some of our politicians over here—provided, of course, you made sure that the bayonets were high, not to

THAT'S WHY THE CIRCUS FOLDED UP! ALL THE PERFORMERS ARE GOING INTO POLITICS—



mention sharp, enough.—A.L., Burlington, Vt.

Critic of Critics Doesn't Like Wet Blankets

IT STRIKES me that C.W.S. must be quite a wet blanket to take the trouble to write such a biting letter in reply to E.P.E.'s suggestion concerning the hobo accommodations on the new streamliners, which was obviously written in a light vein. Or maybe C.W.S. is one of those "economic royalists" we hear about. To Mrs. I.C., of San Jose, Calif., I extend my heartiest congratulations because of her excellent defense of the dirigible. However, I do think that she is much too cold-blooded in her brief remarks on the lives "lost" which create much grief among the families concerned.—J.C.A., Greenwich, Conn.

Sign Language for Motorists Wins Reader's Approval

THAT'S a good idea—the driver who put a sign on the rear of his car to inform other motorists that he was breaking in a new motor and that they should go ahead and pass him. I think the scheme could be adapted to many other conditions met with on the road. For example, a petter's car could carry the legend, "One-arm driver: keep clear." The motorist with a skiful could warn following cars, "I've had one too many: pass at your own risk."

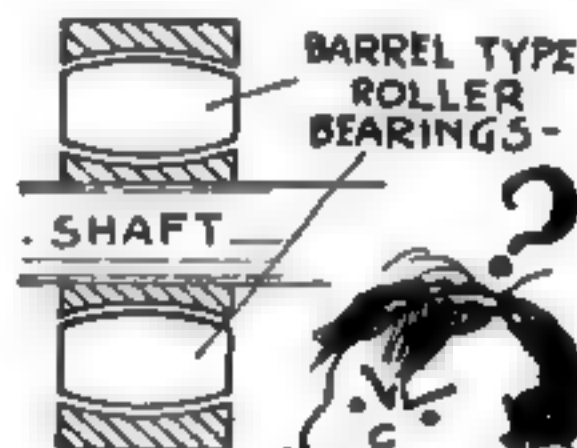
The roadhog's jalopy could be tagged, "I'm taking my half of the road—in the middle." Such a plan would make the highways safer for us all.—E.L.McN., Albany, N.Y.

HERE'S ANOTHER ONE!



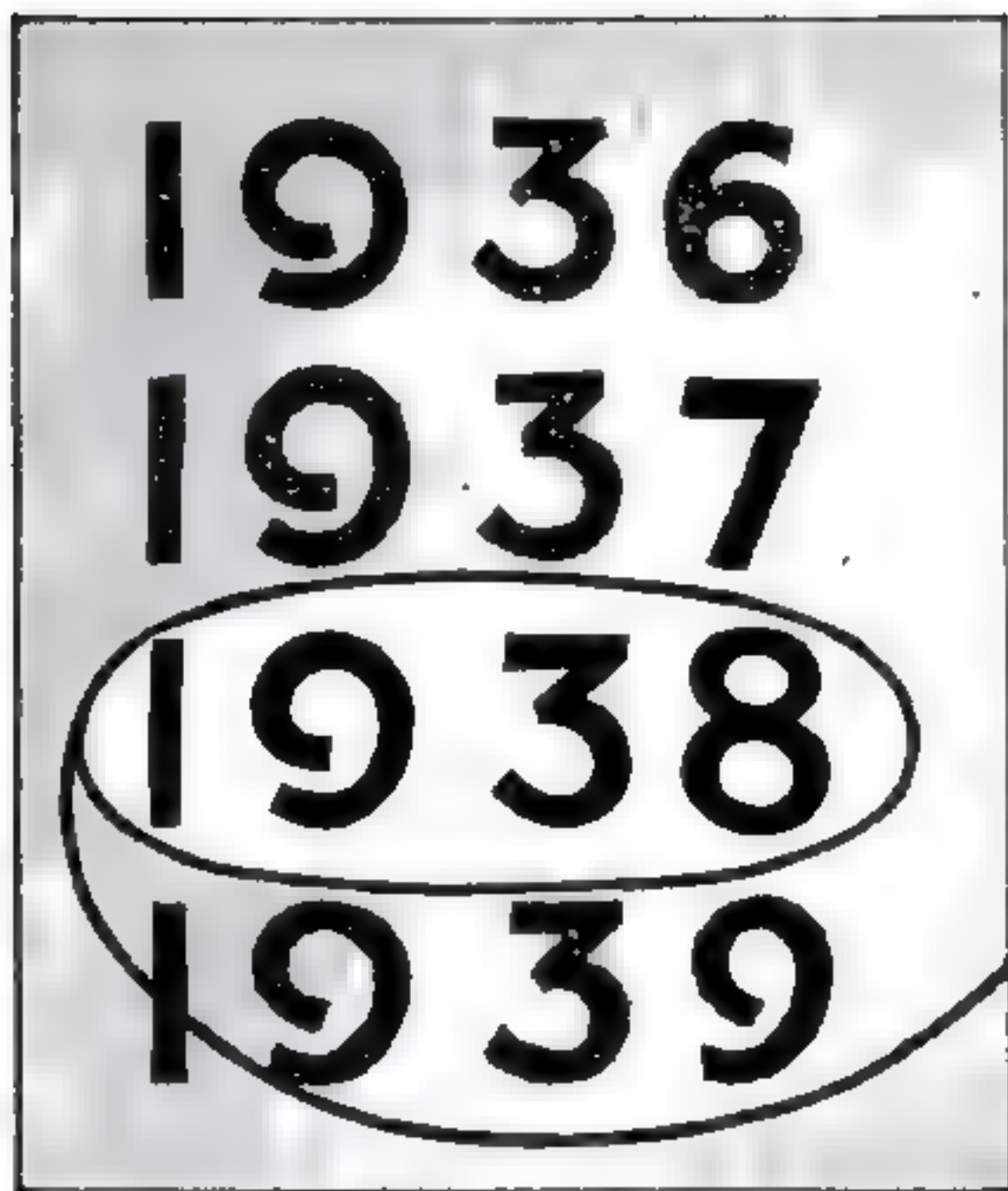
Does the Bearing Slip or Roll? Who Knows the Answer?

As a steady reader, I have no complaints to make about your fine magazine. I especially like your "Readers Say" department, and spend many pleasant minutes over the letters. But now I would like to submit one which I hope will get many replies. I have encountered a roller bearing that has me stumped. The rollers are of the barrel type with ends of a smaller circumference than the middles. It seems to me that as the bearings roll along in their races or troughs, the middles must travel farther than the ends during each revolution. Therefore, there must be some slippage some place. I have asked several people about it, and they say that there is positively no slippage. Now who is right? Is there, or isn't there?—G.L., Mariposa, Calif.



With That Crashproof Plane, Why Have a Superhighway?

IT WAS surprising to see so little comment from readers on the "Highways of the Future" article. Here's mine. In describing one's journey on the highway of 1988, the article states, "perhaps you arrived at the trans-continental highway by plane." If so, why not stay in the plane and make the trans-continental journey at 200 miles an hour or more, instead of changing to an automobile to travel a mere 100 miles an hour? And in your July issue is a plane which can be operated as easily as an auto. Personally, I am not particularly an aviation enthusiast. I wish I could be, as the trend in long-distance, high-speed travel is certainly to the airways. I would not like to see such vast sums spent on a system of highways which might have very little use by the time it was completed. If 164 miles of four-lane highway in Pennsylvania are costing \$80,000,000, I dread to contemplate what the entire 15,000 miles of twelve-lane highway, steam-heated, electrically lighted, electrically controlled, and so forth, would cost! Another thing: That toll of a tenth of a cent a passenger mile surely must be an underestimate. I read in a Cleveland paper recently that if two cents a passenger mile were charged, the pavements of the entire system would have to (Continued on page 14)



Now is the time!

Business is Searching for YOU, if

RIGHT now, in many lines, there is a search for really *good* men—managers, leaders—men who can take charge of departments, businesses, branch offices, and get things humming.

As always, there are not enough ordinary jobs to go 'round—but rarely before, in the history of American business, has there been so much room at the *top*! And new jobs are being created by the business pick-up in many lines—jobs that pay splendidly and that open the way to lifetime success.

Ordinarily, there would be plenty of men to fill these jobs—men in junior positions who had been studying in spare time. But most men have been letting their training slide during these dark years of depression . . . “What’s the use?”—You have heard them say. Perhaps there has been some excuse for sticking to any old kind of a job one could get the past few years—but the door is wide open for the man with ambition and ability *NOW*!

And don’t let anyone tell you that “Opportunity Only Knocks Once”—that’s one of the most untruthful sayings ever circulated. Op-

portunities flourish for *every* American every day of his life.

Far more to the point is to be ready—to be *prepared*—to make yourself *interesting* to the big-time employer—and LaSalle offers you a short-cut method of qualifying for opportunity jobs in accounting, law, traffic, executive management, and kindred occupations.

LaSalle Extension is 30 years old—averages over 30,000 enrollments a year—60 American firms each employ 500 or more LaSalle-trained men—surveys show that many LaSalle students attain 40% salary increase after graduation—10% of all C.P.A.’s in the U.S.A. are LaSalle-alumni.

Why not find out what LaSalle has done and is doing for men in *your* position? Send and get the facts; see what LaSalle can do for you, personally!

There’s no question about it—business is picking up—jobs are looking for *men*—the time has come for you to *qualify* for prosperity. Mail this coupon today!

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Our Readers Say (CONTINUED)

last sixty years in order to make the project self-liquidating. Of course, it would be a grand thing for the pork-barrel boys to get along on for years to come, but what a white elephant!—B.H.N., East Cleveland, Ohio.

Then He'd Be As Happy As the Day Is Long

I WAS interested in your story of the two scientists who lived for a month in Mammoth

HOW ABOUT ALL THE LABOR
COUNTING UP TO 52



Cave to see whether they could adapt themselves to a twenty-eight instead of a twenty-four-hour day. Now that air-conditioning, artificial lighting, and other modern inventions have made us independent of daylight and the seasons, it is foolish for human beings to regulate their lives according to the crude, primitive divisions of time. Personally, I'm in favor of a day composed of fifty-two hours, of which two or three might be devoted to work.—A.J.L., San Francisco, Calif.

How To Grow Asparagus in One Easy Lesson

NO GRAFTING with candy sticks is necessary, M.G., to produce the succulent asparagus you ask for. Just cover the asparagus bed with red clay about two inches deep, soak it with water, and let the sun bake the ground. The asparagus will grow large enough to lift the clay, but to do this it will have to grow in strength, too. Your product will be all white, and you'll have just what you asked for, better than if you really could cross it with a "candy stick," or what have you.—P.A.H., High Point, Fort Madison, Iowa.

A Plea for Another Look at the 200-Inch Telescope

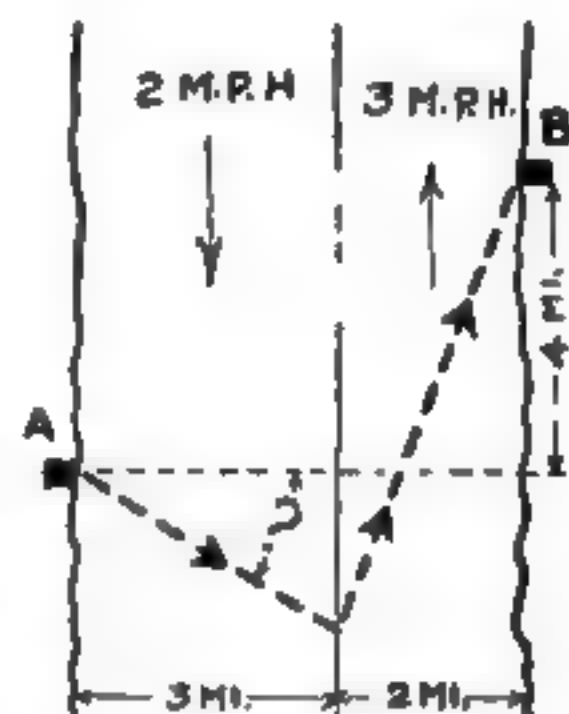
ALONG with a lot of other readers, I would like to know what progress is being made with the new 200-inch telescope now under construction. I read your earlier stories about the giant mirror, and the even "giant" mechanism to hold and control it. But what is the present status of all this? I feel sure that many of the details of the actual assembling of this huge eye would make interesting read-



ing. Hope you will be able to give us a story about it pretty soon.—W.C., Delaware, Ohio.

It's a Tricky Channel, and Problem, Too

PERMIT me to contribute a problem. On the parallel sides of a channel five miles wide are situated the villages A and B, one four miles from a point opposite the other. For a width of three miles on A's side of the channel, the current flows south at two miles an hour. The rest of the channel flows north at five miles an hour. Now, at what angle from the shore would you set out from A to reach B in the shortest possible time, if you can row no faster than seven miles an hour? Your mathematicians will find the problem a stiff one.—A.T., Victoria, B.C.



Just Reflect a Minute and You'll See What He Means

IN YOUR September issue, B.M.B. states that he wants to know why, when you look through a magnifying glass into a mirror, and the mirror reflects back through the glass, your image isn't normal again. Why, anyone can see that! The glass magnifies your image and the mirror sends back your magnified image to the glass where it becomes magnified again. And say, in case you ever decide to drop one of your departments, don't let it be the "Question Bee."—R.W., Norwich, Conn.

Perhaps Two Separate Cars Would Be Even Better

SAY, where can I get one of those dual-control automobiles you described in your October issue? After a vacation car trip with my wife, I am convinced that this is the only practical solution for our motoring problem. Suppose I am driving along at a good speed in my old-fashioned, single-control car; my wife spots a tempting antique shop or tea room, or makes up her mind that I am taking the wrong turn at a fork in the road. By the time she has told me about it we are a half mile farther on, and have to turn around through a stream of (Continued on page 16)



1898
—then came
the guarded blade

1776
Men used the
straight blade

1938
—and now the improved
Schick Shaver (no
blades—no lather)

\$12.50
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Why men, inevitably, will come to SCHICK Shavers

● Some men will use straight razors until they die. Others persist in shaving with safety razors. There are types of men who will try all kinds of shavers before they finally and inevitably come to the Schick Shaver.

Electric dry shaving is here to stay. It is destined to be as certain a part of our lives as radio and telephone. Die-hards may postpone the joys of dry shaving, but the day will come when practically every man who shaves will be freed from "blades, lather and scraped faces."

Why should men use Schick Shavers?

Schick patents, with eight more years to go, embody the vital principles of dry shaving—the absence of sharp cutting edges, cutting *underneath* a thin guard plate, a combing edge to pick up close-lying hairs and guide them into the cutting slots and shaving *without injury to the skin*.

Schick who invented the shaver, Schick who created the industry, marches on far in the lead with a single, unchanging purpose: To bring the pleasure and comfort of dry shaving to the millions at a price consistent with the fine precision of the machine and the service it must render.

The standard Schick Shaver is now \$12.50

When the first Schick Shavers were sold, the price was \$25. Later, this price was changed to \$15. Now it is \$12.50—all these steps being part of a plan made by Colonel Schick years ago. Look to Schick for new developments in dry shaving—for constantly improved and refined mechanism—maintaining and increasing leadership through keen competitive conditions and many conflicting claims on dry shaving. For "Schick was first—Schick is first."

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Our Readers Say (CONTINUED)

traffic going hell-for-leather. With a steering wheel and controls of her own, she could just yank the car out of my hands and stop or turn at once, saving a lot of time and argument. Of course, I realize that this might complicate traffic, occasionally, but the better half couldn't razz me about it if she caused a traffic jam with her own set of controls.—T.M., Oshkosh, Wis.

Twelve Good Reasons for Owning a Home Workshop

MANY men like myself probably have built up over the years, with loving care, a home workshop. They, too, have probably had to defend themselves to their wives and friends as to why such an investment was justified. Having one of these shops, I have accumulated and quote often such answers as these, which some of your readers can add to: 1. My business is a major complex; my workshop is

WHY I'M A
WORKSHOP FAN



a minor one. 2. I can tinker until midnight without fatigue. 3. It keeps me home—rain or shine. 4. I like the smell of its paint and shavings. 5. I like to look at all my tools—pride of possession is a great satisfaction. 6. It stimulates constructive thoughts. 7. My wife always knows where I am. She is never a golf,

fisherman's, or duck hunter's widow, and can sit in my shop and watch me. 8. It keeps me from thinking too much about myself and provides me with many happy hours. 9. It is a mental rest. While working in it, I have no mind for mean thoughts. 10. Many a man has spent more than this shop cost for golf clubs, horse races, or a collection of postage stamps. 11. I spend money in hardware and paint stores, where I am always a welcome customer. 12. The funny contraptions I turn out quiet my nerves and rest me.—And so on, these good reasons go. With best wishes for continued success to your magazine, to which I have been a subscriber for a very long time.—R.D., Stockton, Calif.

Here's One Suggestion for Dimming Those Headlights

AN ITEM in a recent issue telling of a new kind of automobile headlight that automatically throws light rays downward as the car climbs a hill shows that at last something is being done about the problem of automobile lights. I have often wondered why headlights were neglected while engineers were designing improvements in braking, steering, gear shifting, and the like. With photo-electric

cells doing every conceivable kind of a job nowadays, why can't they be put to work to dim headlights automatically when two cars are approaching each other from opposite directions?—C.J.S., Syracuse, N.Y.

Or He Might Just Leave It in a Tub of Water

ON PAGE 15 of your June issue you say that a garden hose will last longer if it is always drained thoroughly after use. You may be correct, but my experience has been to the contrary. Furthermore, I was once told by a neighbor, who was the president of a concern manufacturing belting and hose, always to keep water in the hose so that the inside rubber would not crack and disintegrate. He said that to store a hose, it should be filled

I'LL HAVE TO TAKE UP CIGARETTES SO I CAN PATCH THIS!



with water and its ends coupled together to prevent evaporation of the water as much as possible. Of course, store it where it will not freeze in winter. I have been doing this for years with my hose. And here's a method I found most satisfactory for repairing splits, bubbles outside the casing, and so on. I wind transparent cellulose from cigarette packages around the hose. Over this I put black friction tape, and shellac it. It makes a perfectly tight patch, easy to put on, that does not easily wear off.—J.S.C., Winthrop, Mass.

He Got All Steamed Up over Steam-Powered Airplanes

WHATEVER became of the steam-powered airplane which you featured in an article several years ago? After reading about it, I concluded it was a swell idea and expected to see it become a rival of the gasoline airplane within a few years. The steam engine has an advantage over the gasoline engine in the stratosphere; namely, it is more efficient in low air pressure than in high. Besides, the extreme cold of the stratosphere would hasten condensation of the steam vapor. We are hearing so much these days of high-altitude flights that I wonder why airplane designers and inventors have not done more to develop and perfect the steam engine for use in airplanes.—J.W., Jr., Greensburg, Pa.



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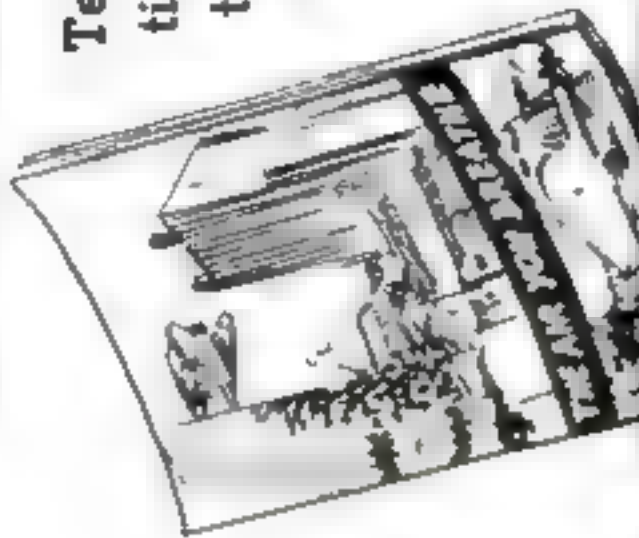
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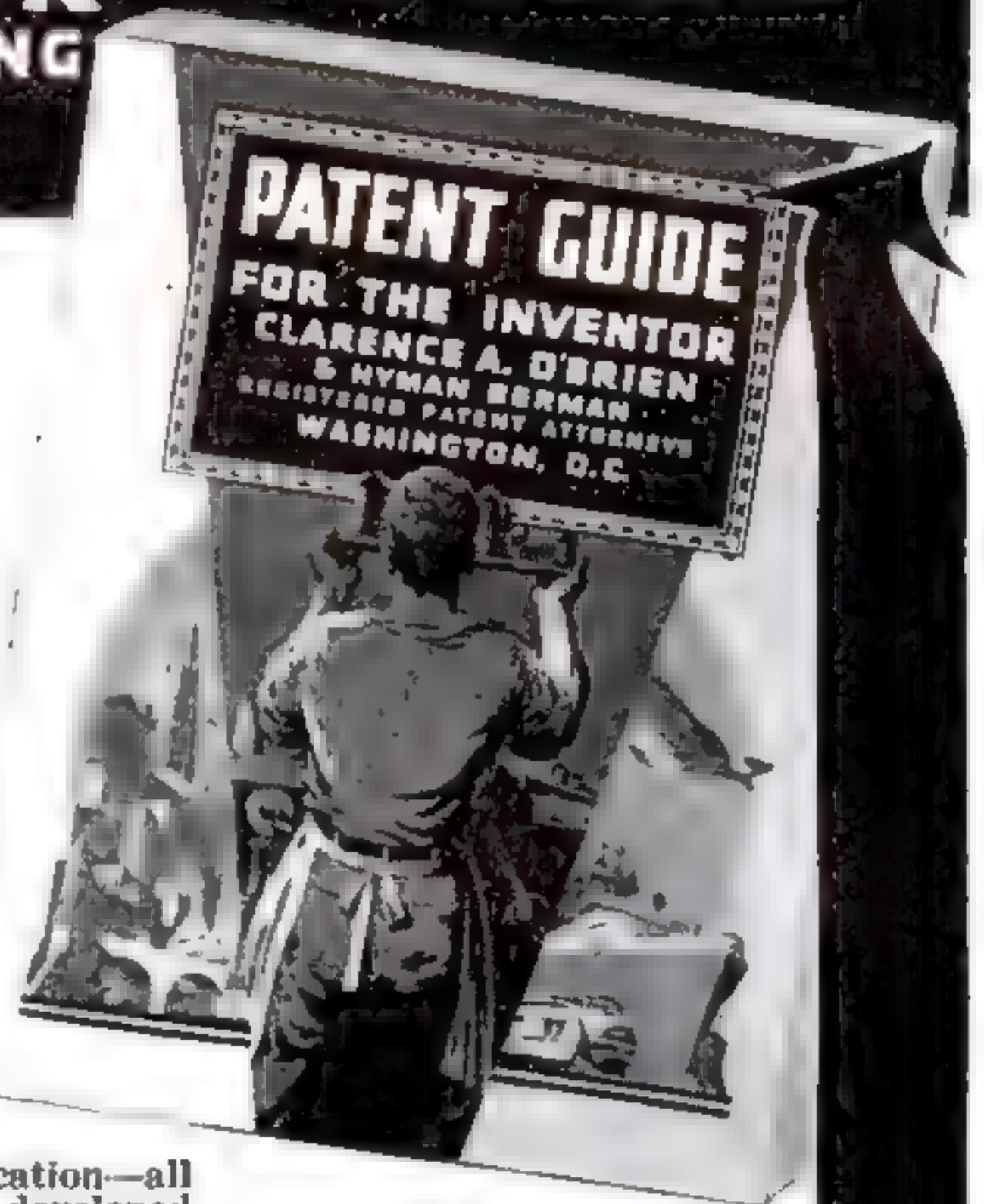
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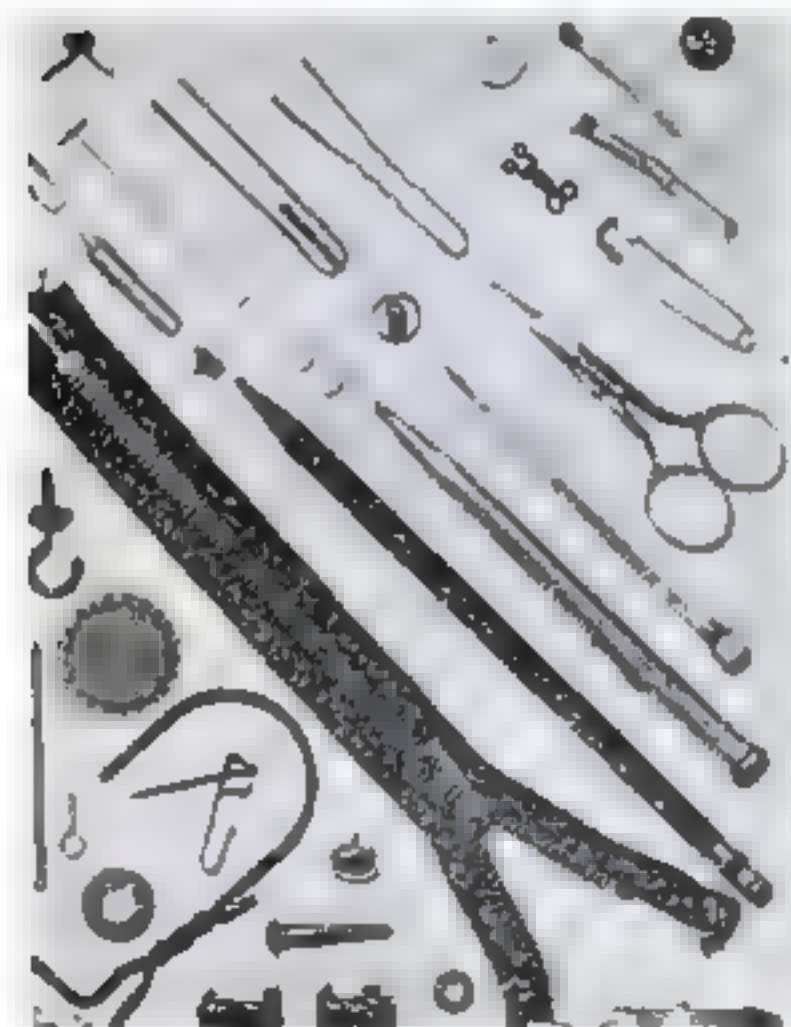
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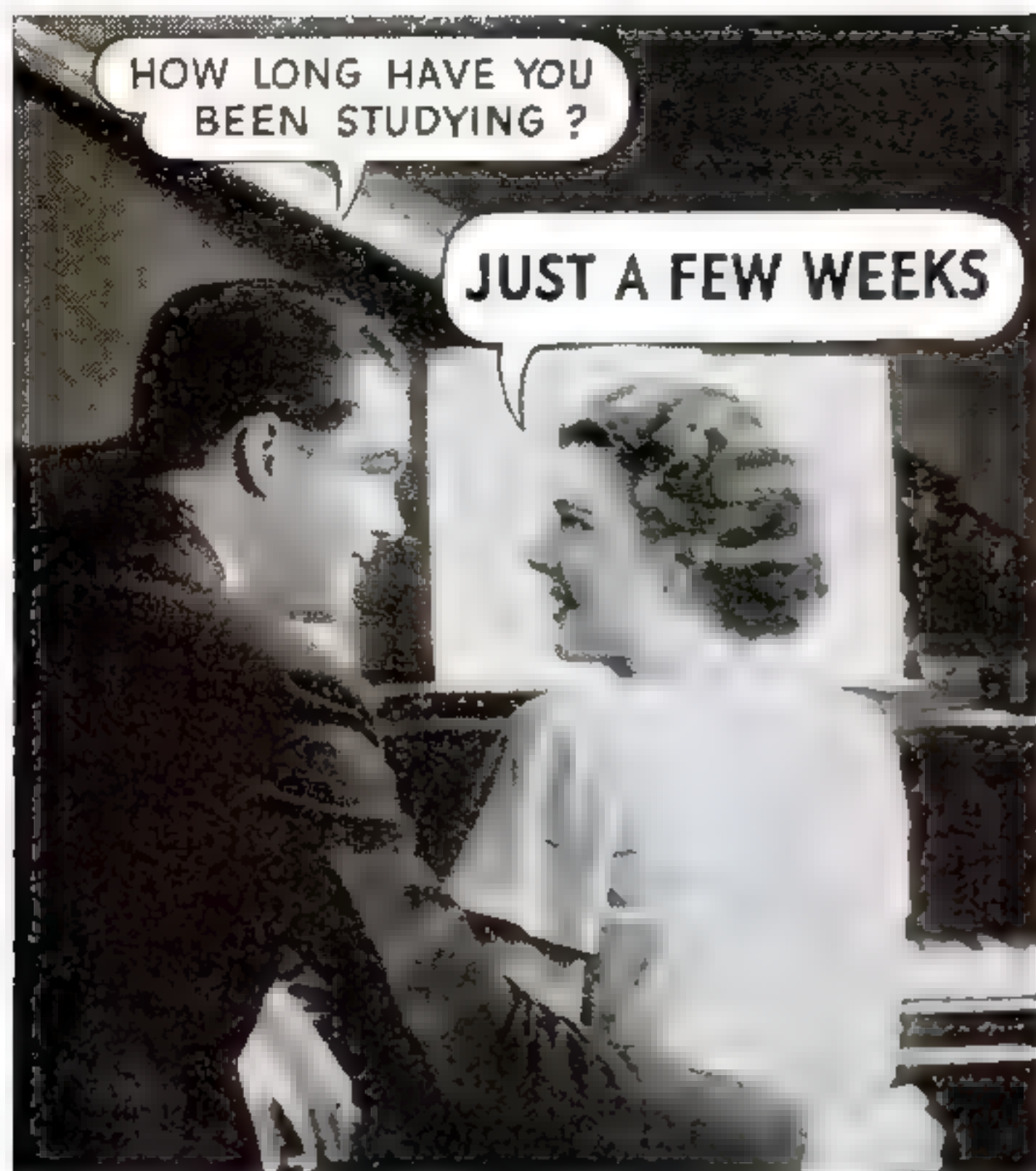
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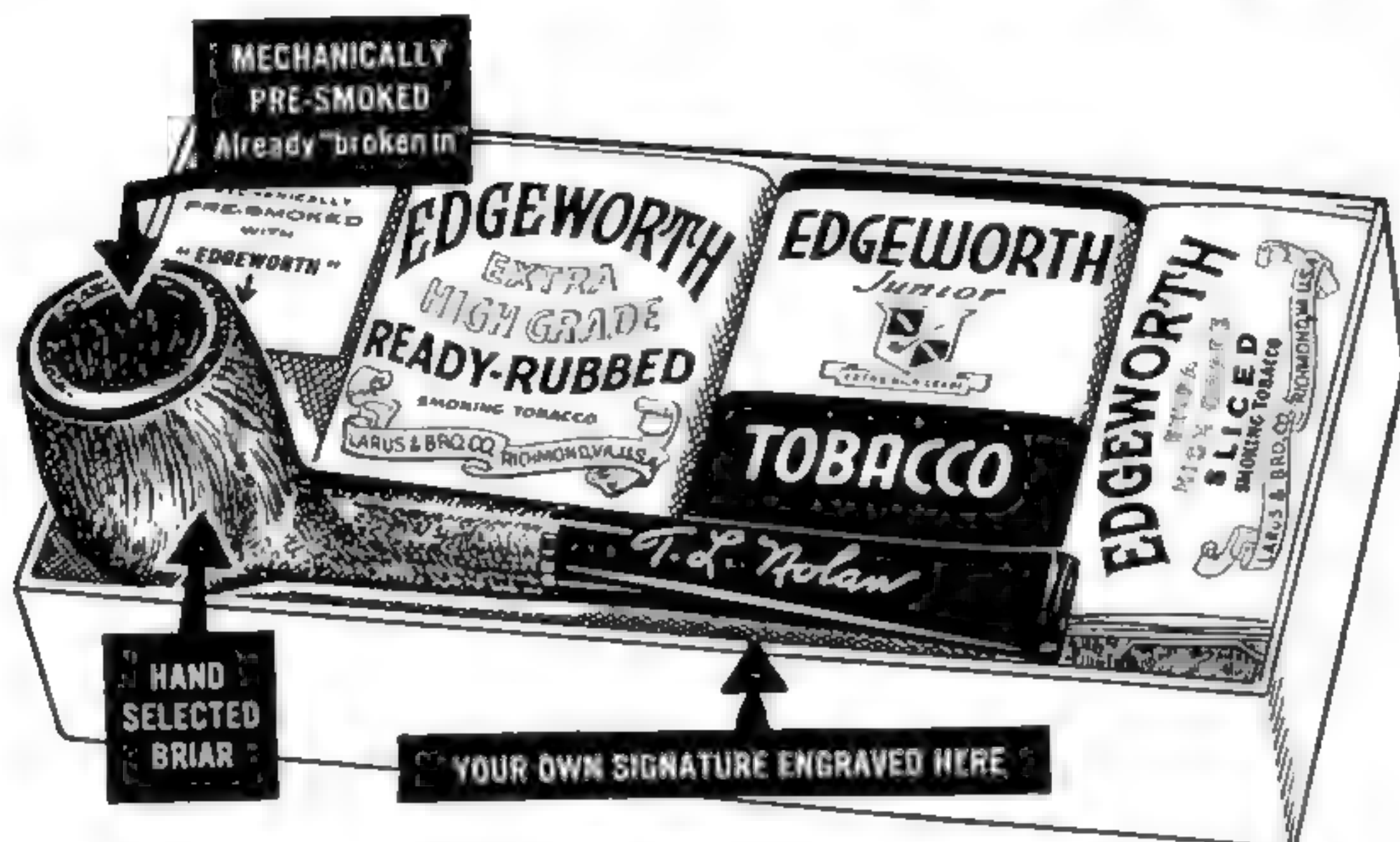
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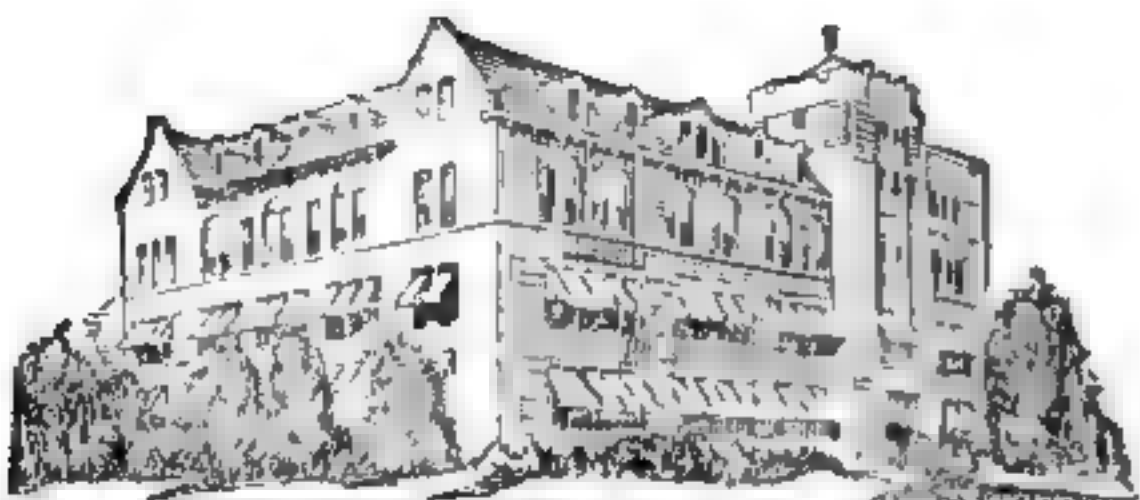
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container that carries the keys between layers of material arranged like the leaves of an indexed address book. One key is fastened to each leaf, while a printed tab indicates its use. Any key can be selected easily for use, as shown in the drawing at the left.



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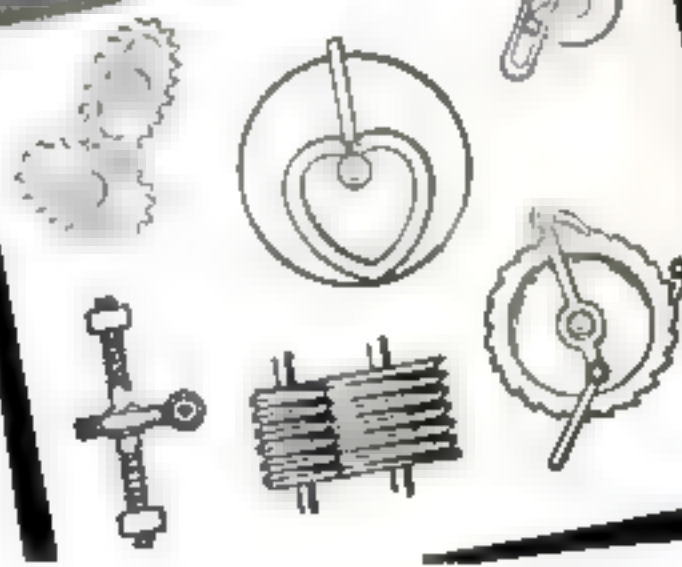
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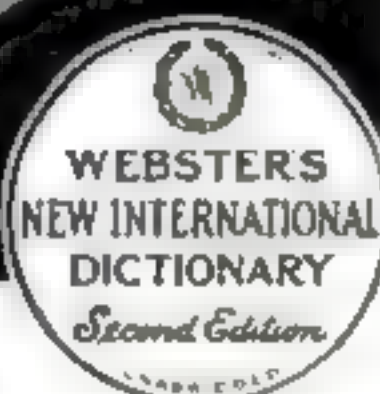
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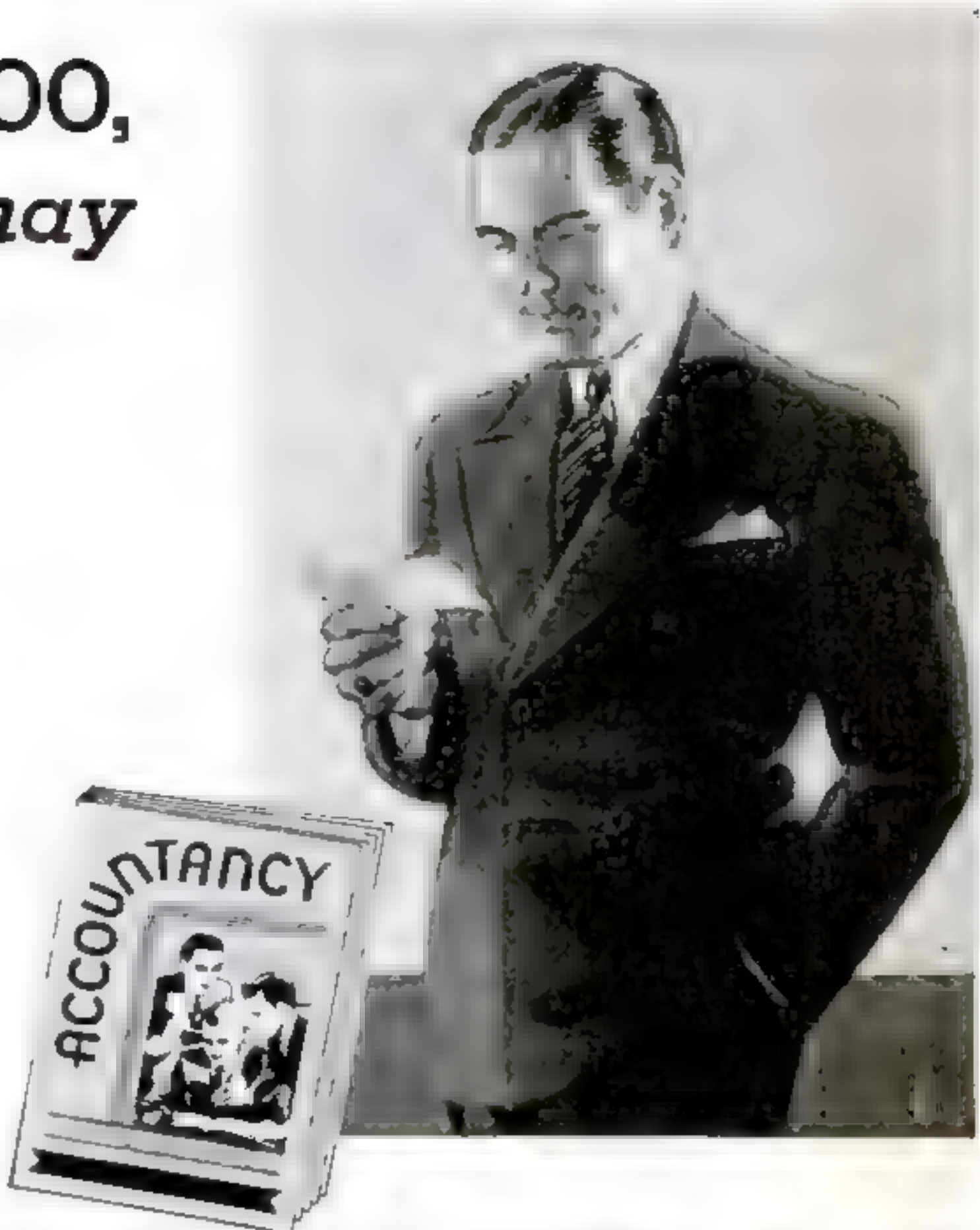
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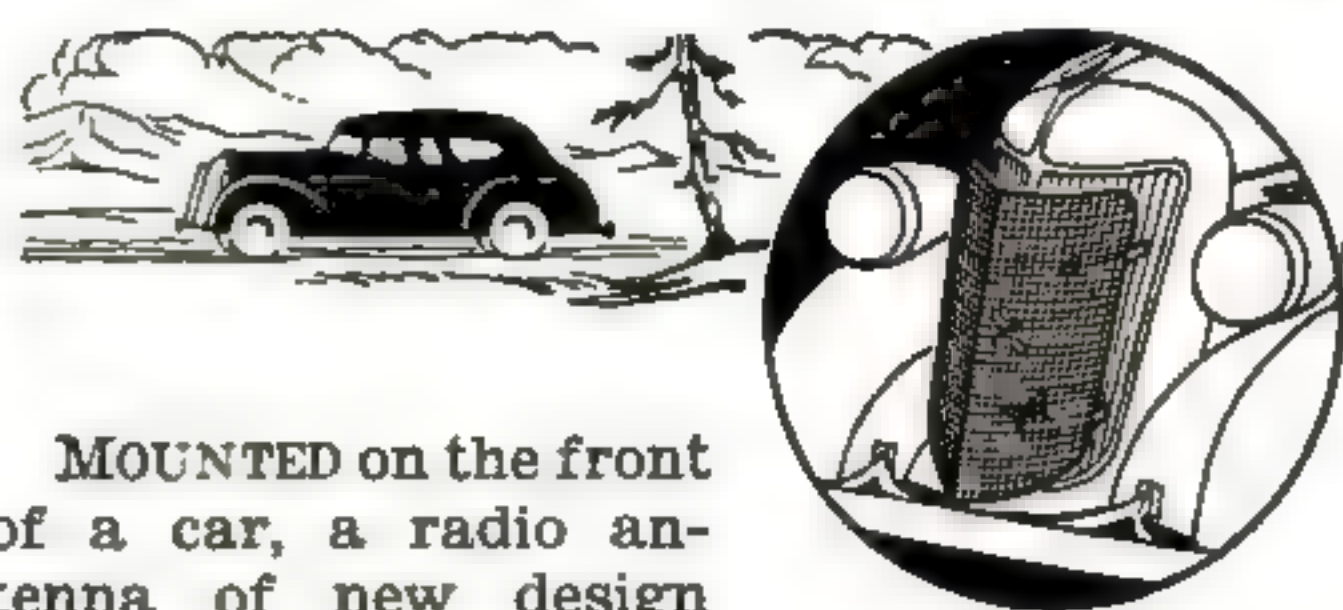
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MOUNTED on the front of a car, a radio antenna of new design serves a double purpose, since its screenlike construction also prevents flying insects, leaves, and other objects from clogging the cells of the radiator. Insulating brackets attach the combination unit, devised by G. G. Wareing, of Blackfoot, Idaho, to the radiator grille as shown.

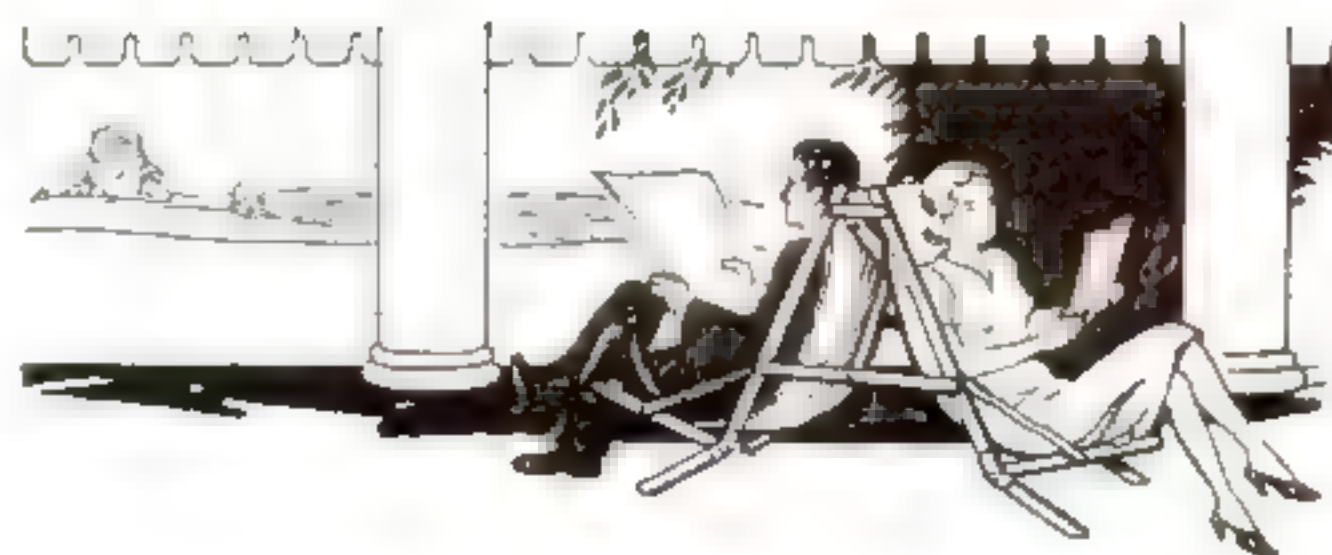
Front-Drive Scooter

BY ALTERNATELY pushing and pulling the handlebars, a youngster can propel a scooter of new invention at a lively clip. A stroke in either direction gives the front wheel a forward impulse through a pair of overrunning clutches—a refinement of the principle of the ratchet wheel for one-way motion. When the handle is held stationary, the scooter free-wheels for ordinary coasting. A sturdy frame supports a bicycle-like seat for the rider, who steers the front-drive scooter with the same bars used for propelling it. The inventor is John M. Welch, of Houston, Tex.



Cot Turns into Chairs

A **PORTABLE** cot that turns into a pair of chairs has been invented by David Rosenbaum, of Baltimore, Md. Hinged at the center, it is used as shown during daytime hours. At night, a moment's adjustment transforms it into a bed resembling a camp cot. For carrying or storing, both its side and cross members fold to form a compact bundle.



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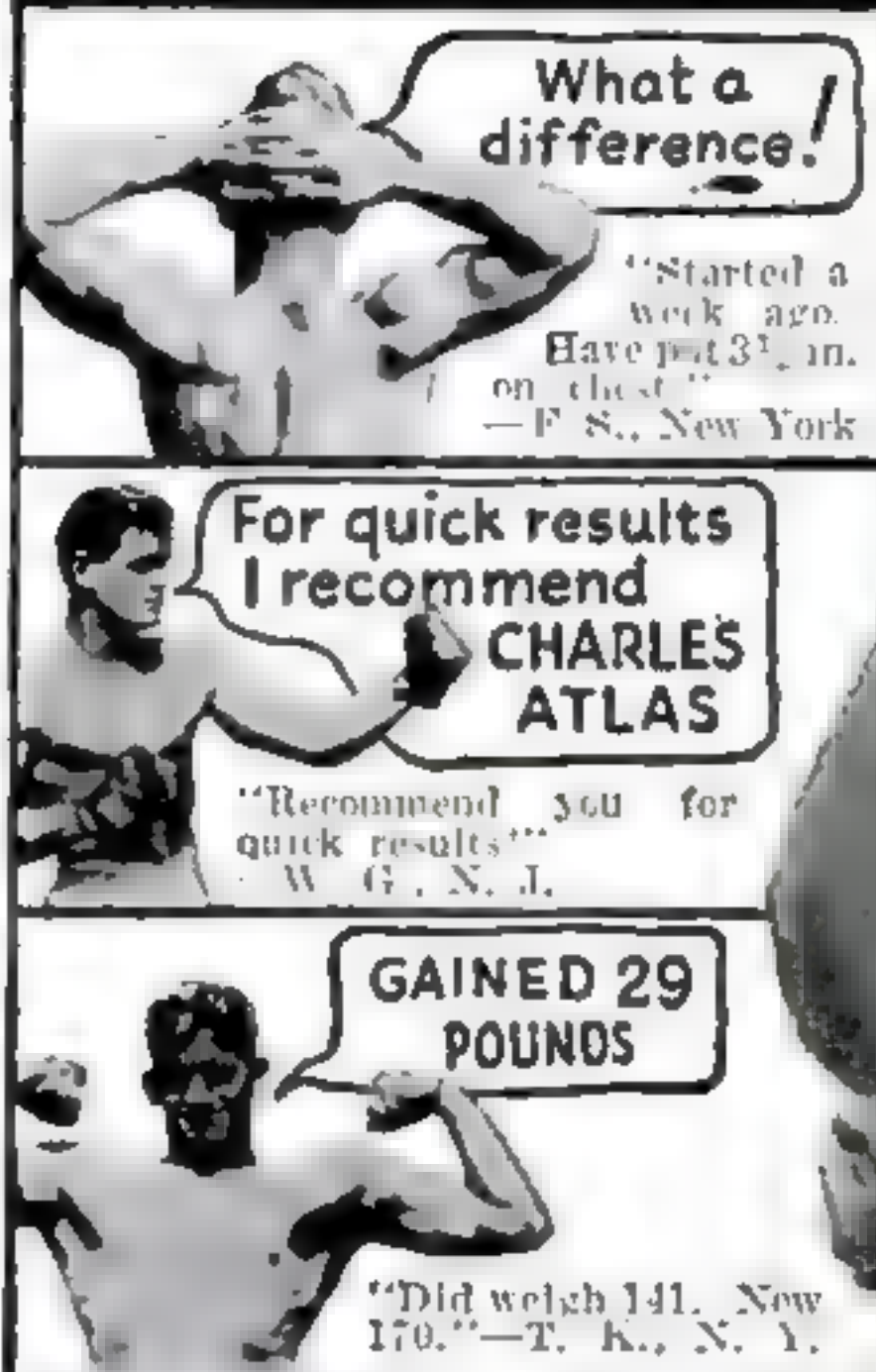
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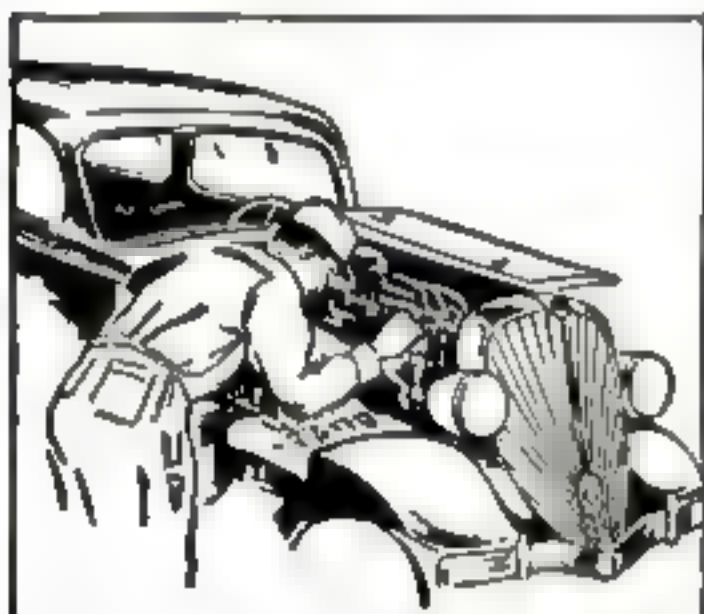
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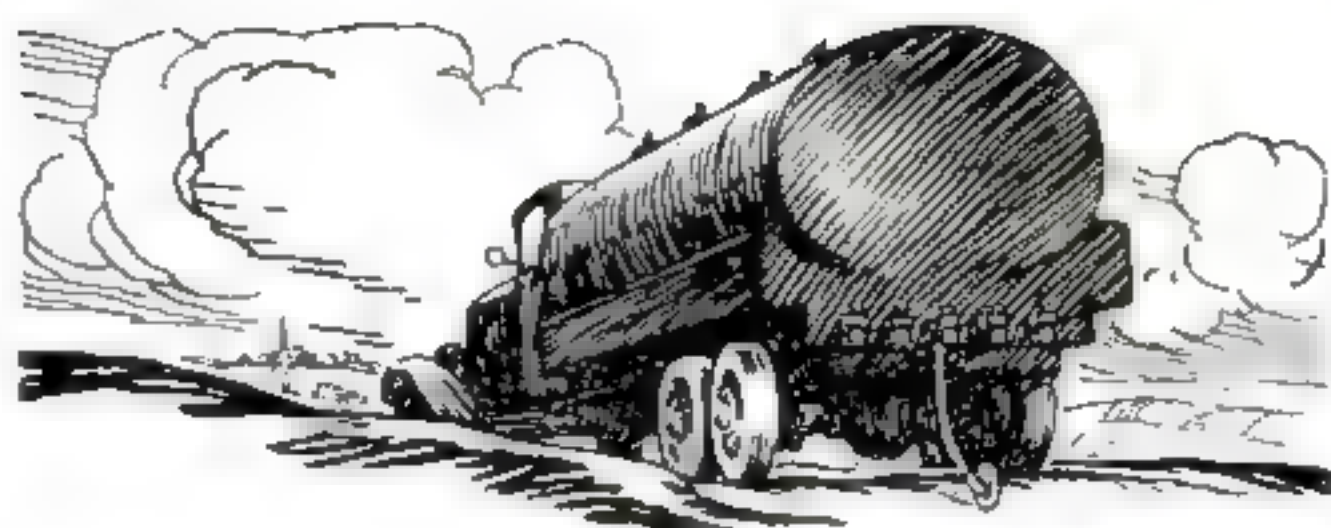
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Headrest for Bathtubs

TO MAKE a bathtub more comfortable, an adjustable headrest, shown in use at the right, has been designed by Stella Rotolo, of Elizabeth, N.J. The bather reclines against a



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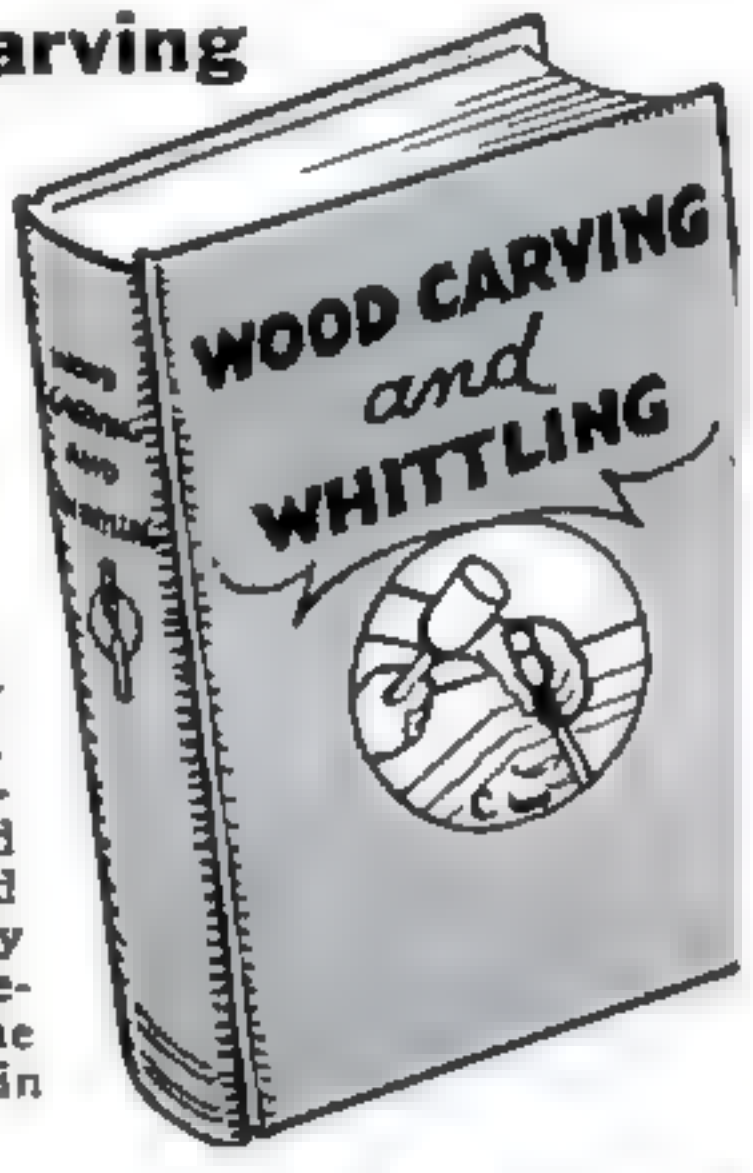
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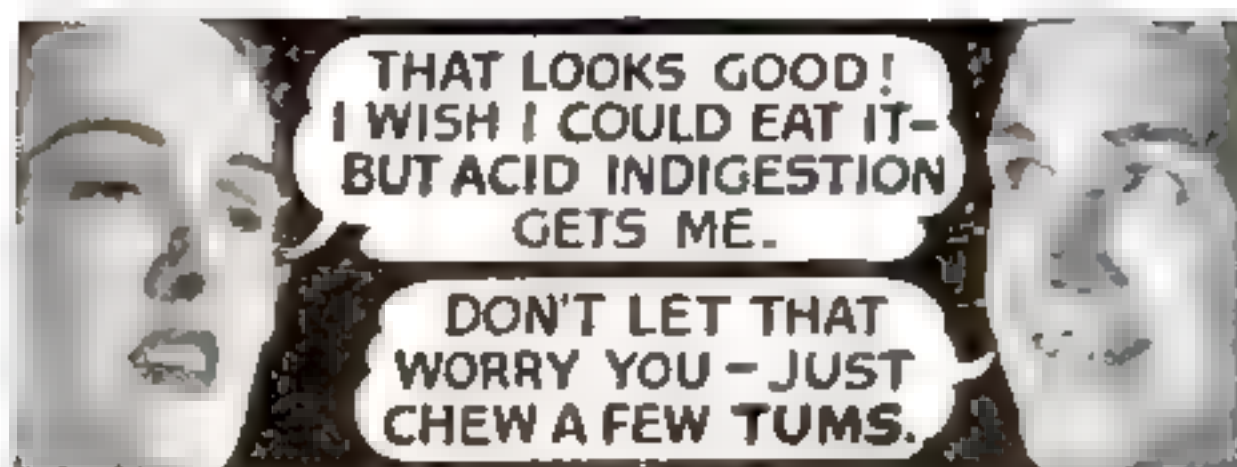
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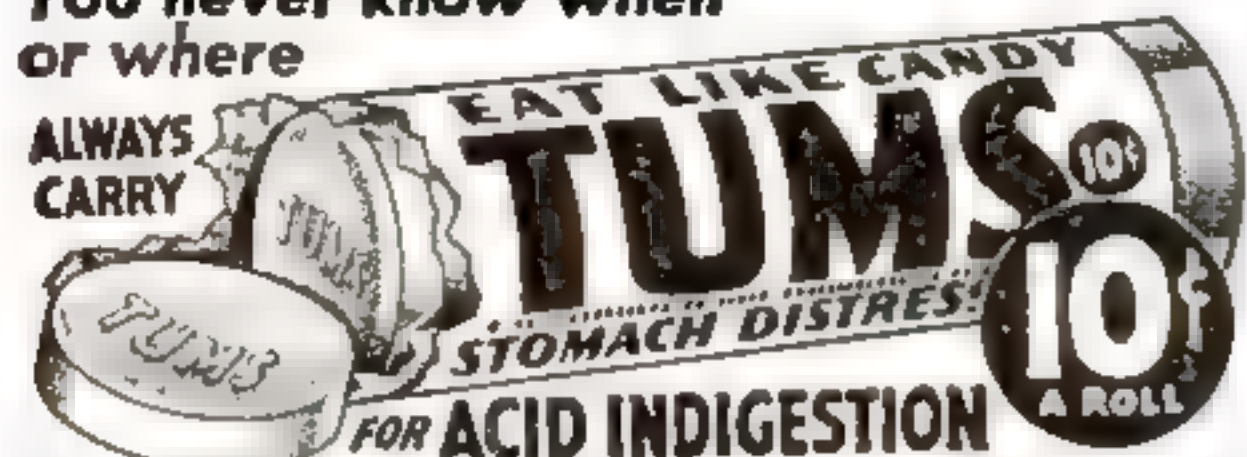
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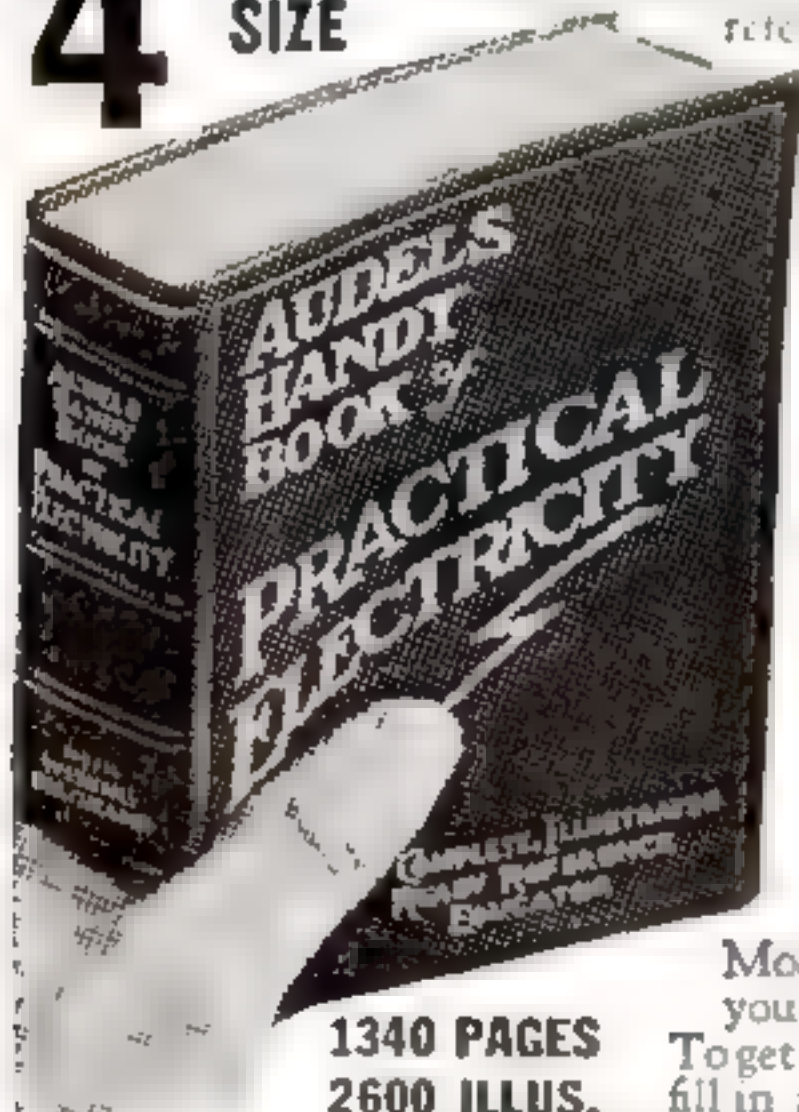
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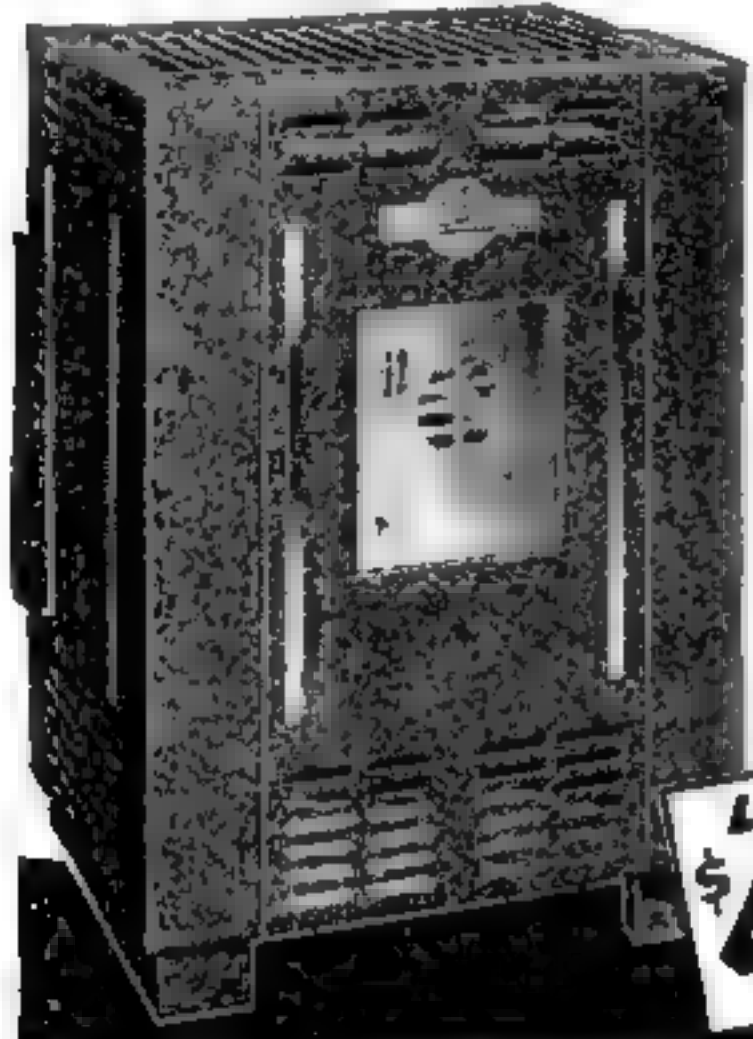
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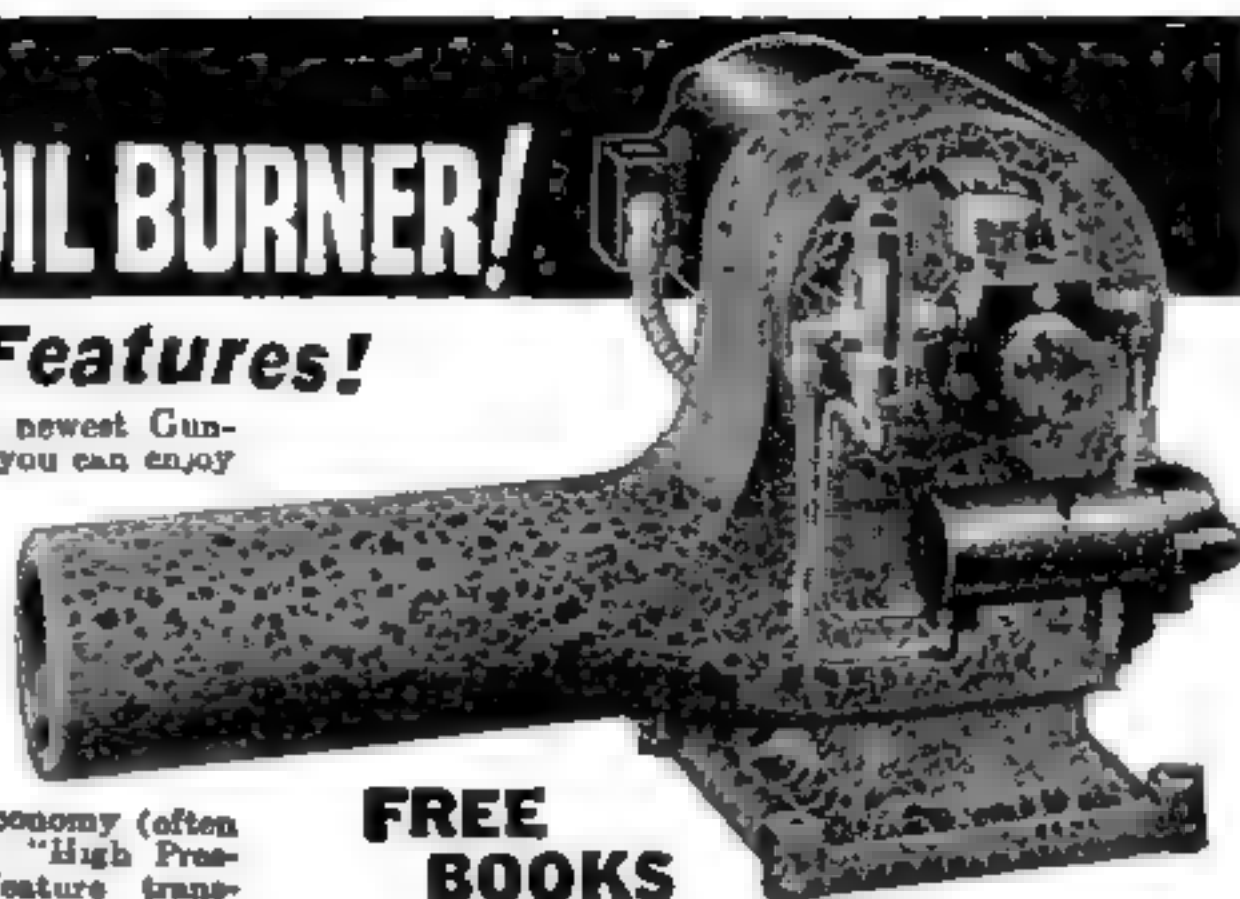
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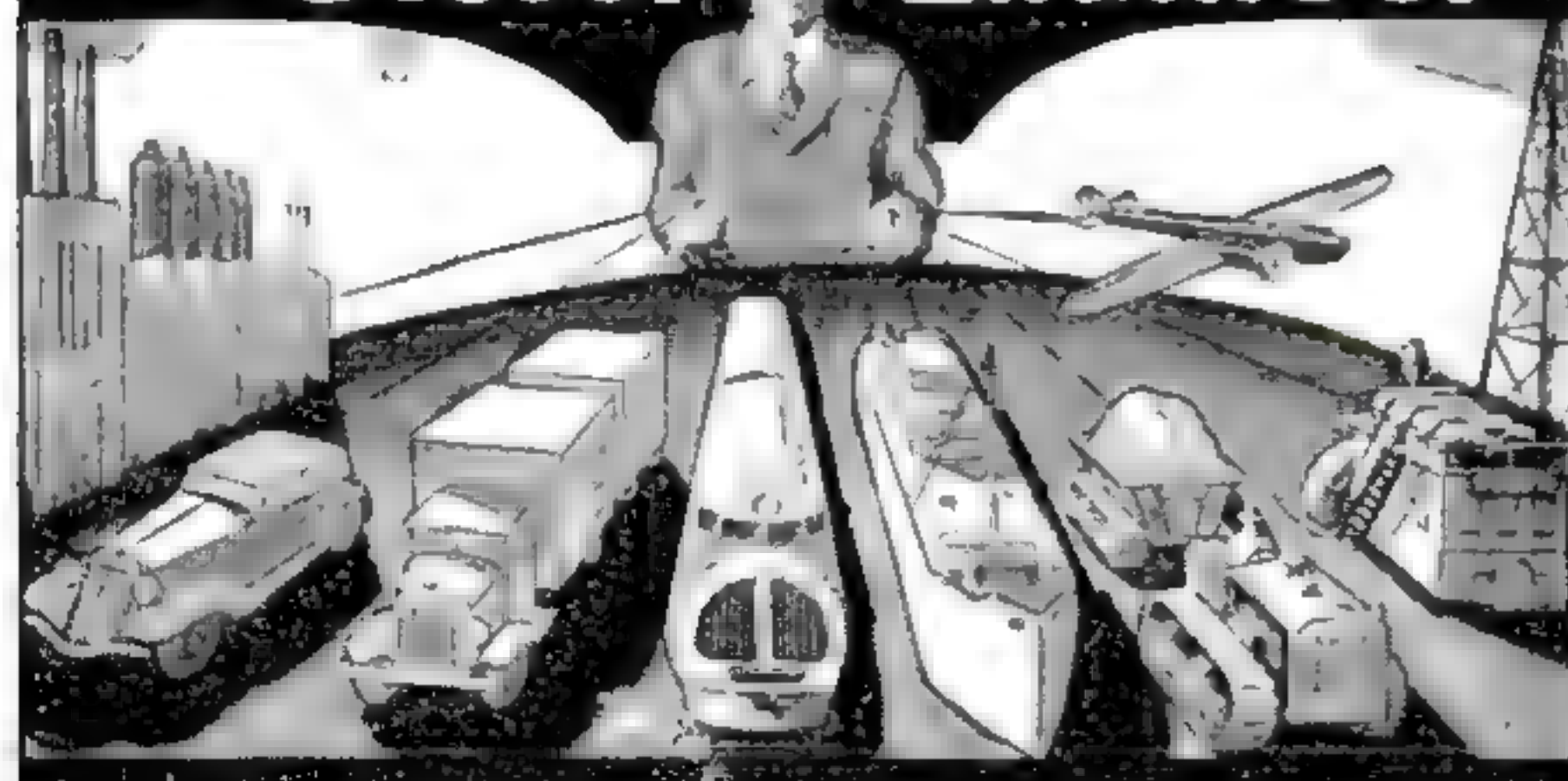
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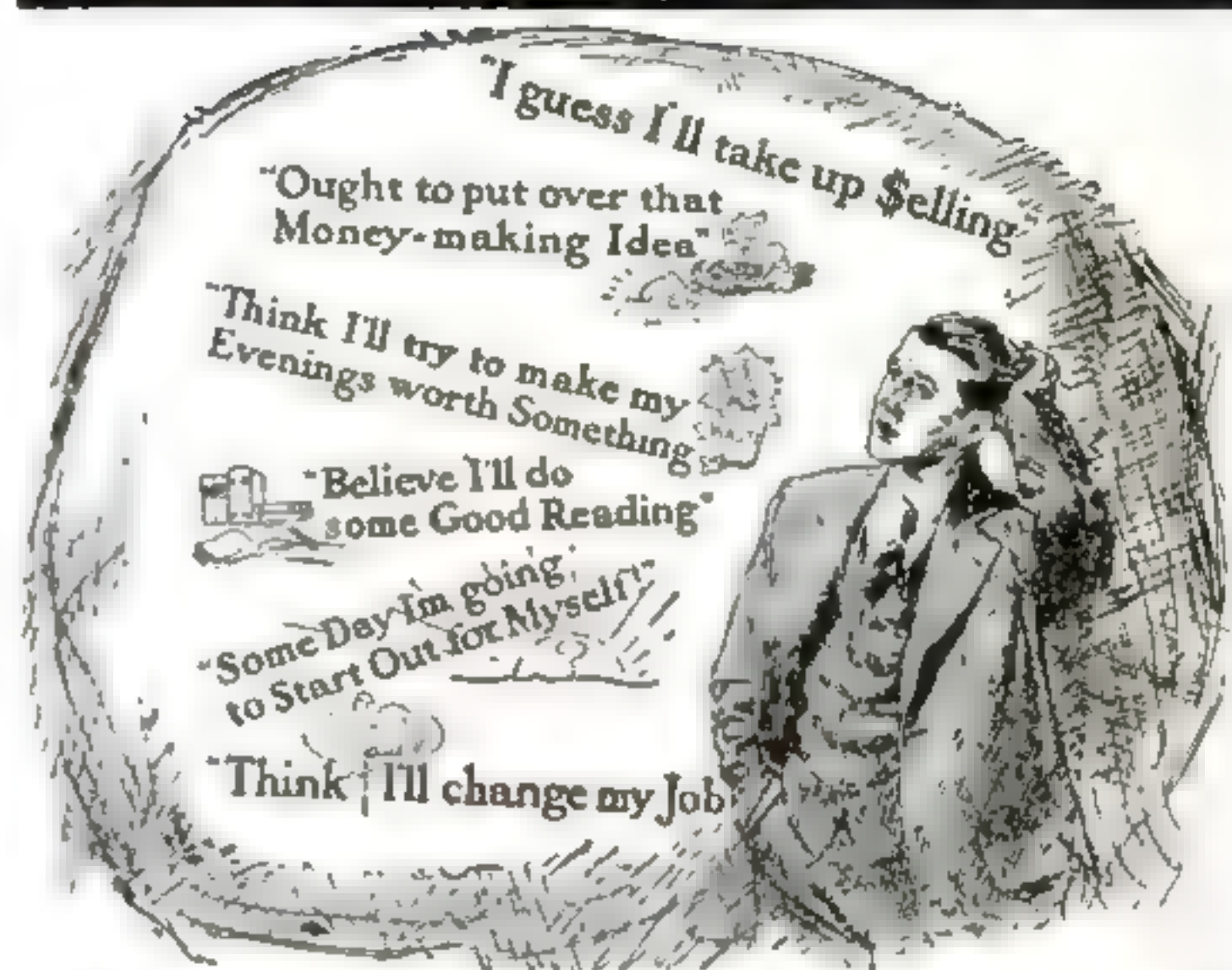
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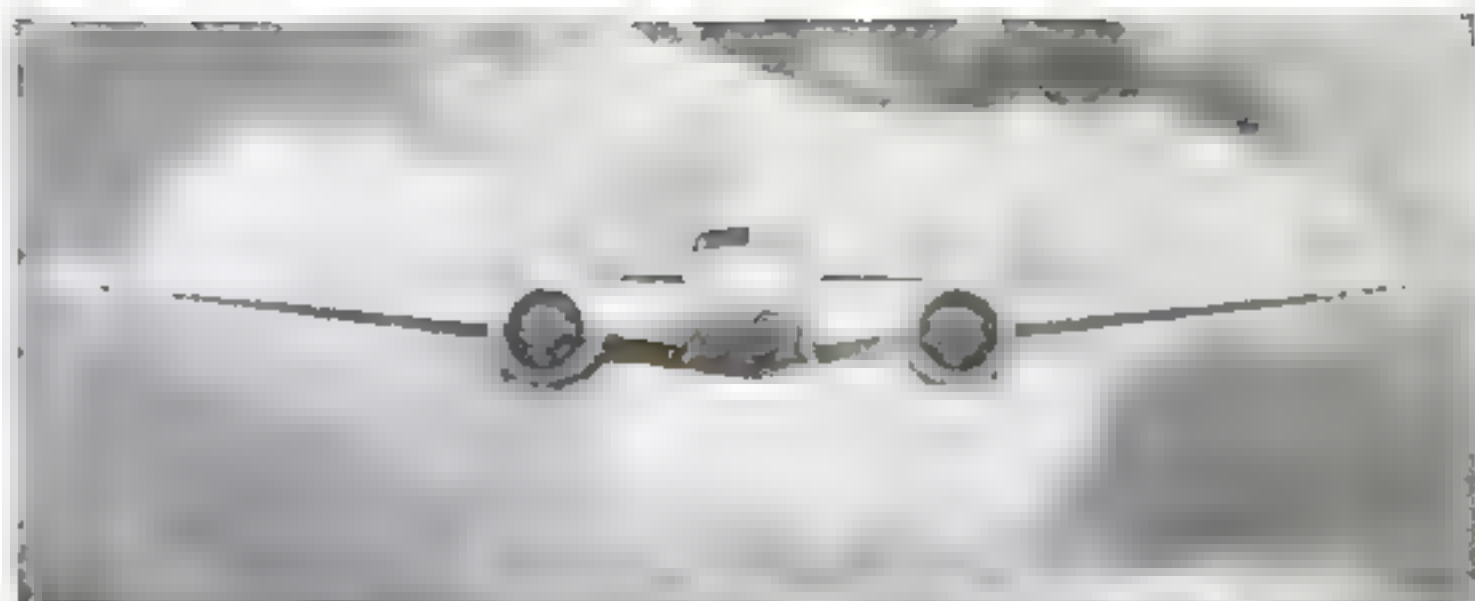
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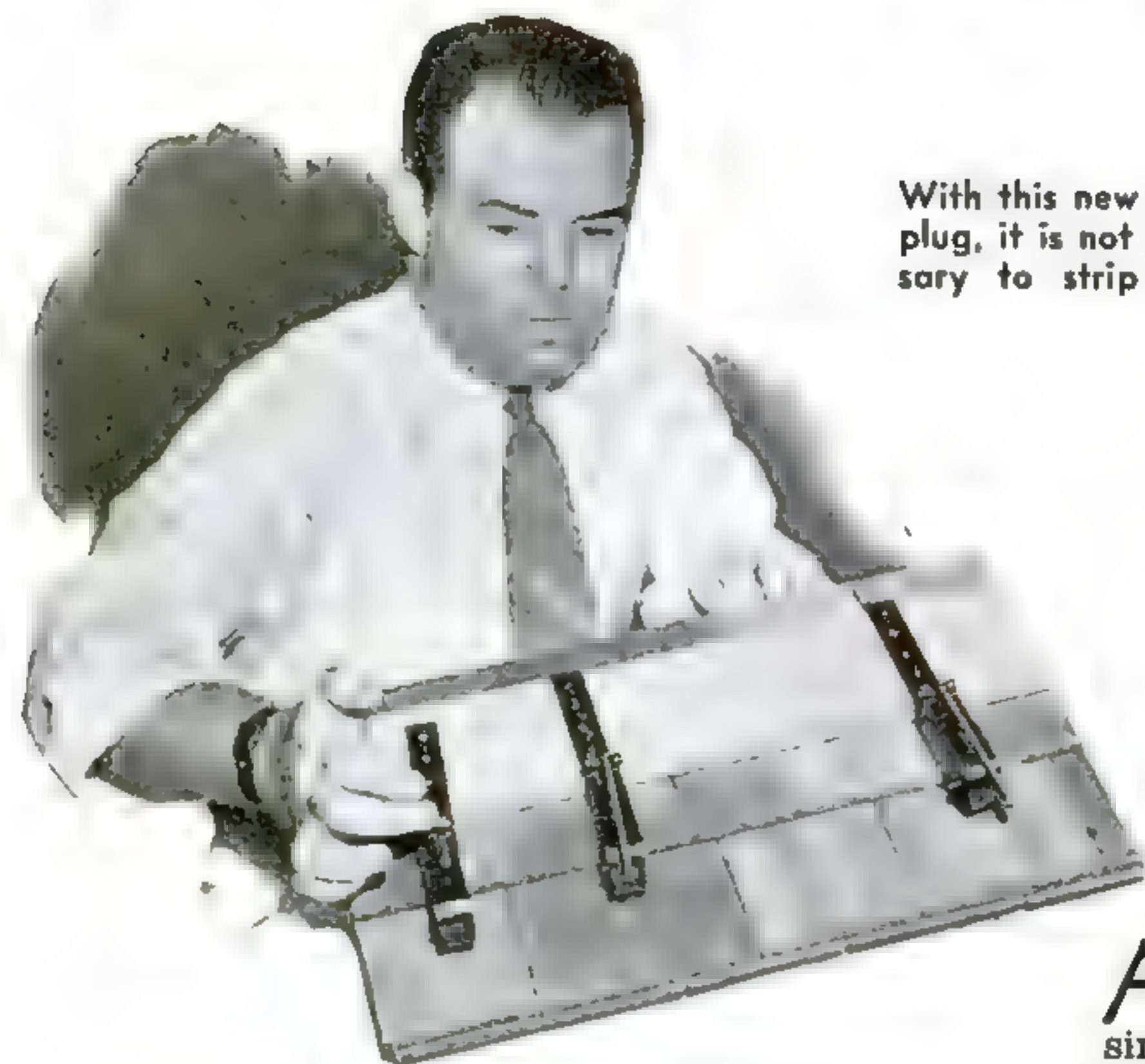
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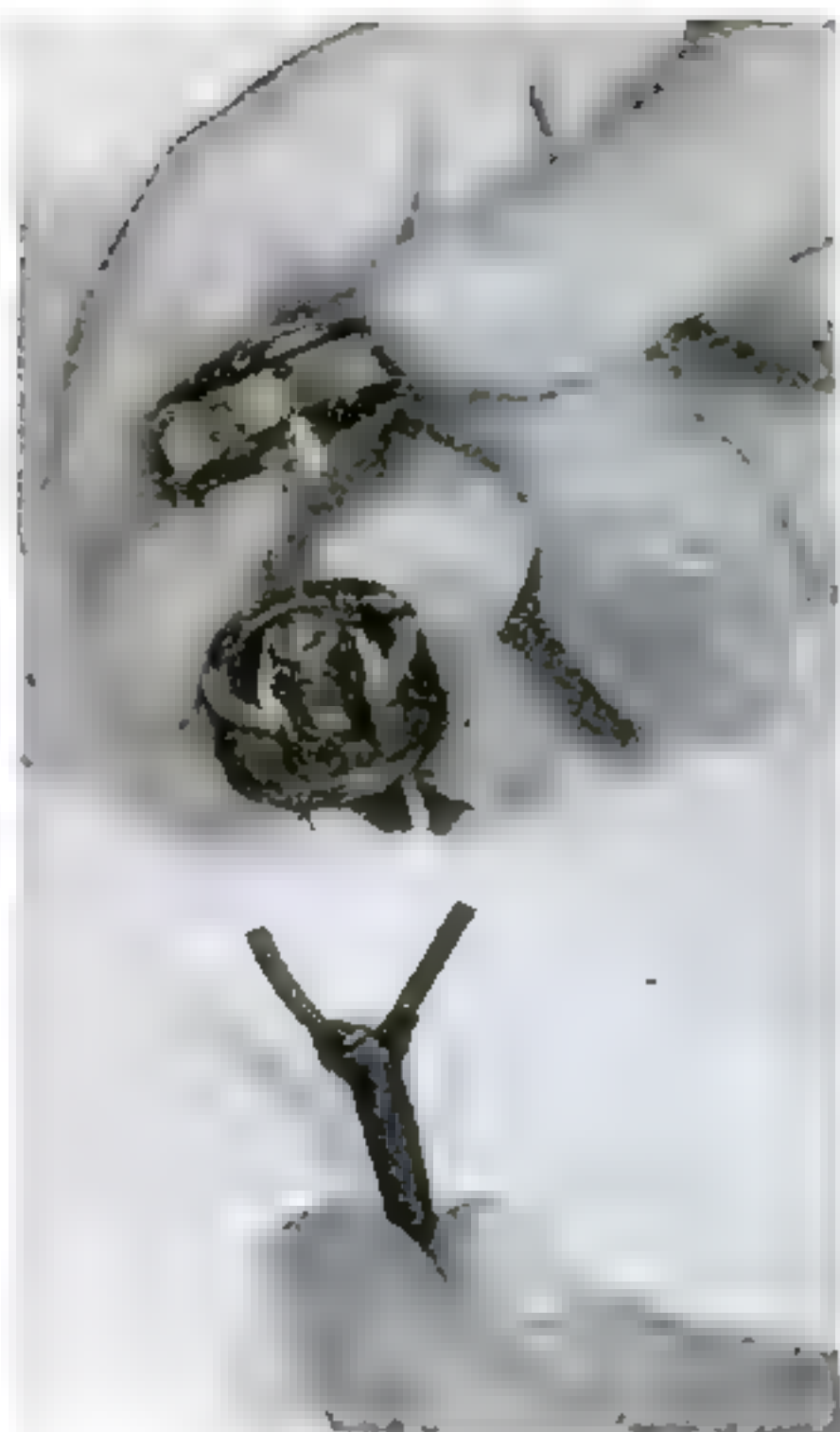
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Handy Aids

FOR HOME OWNERS



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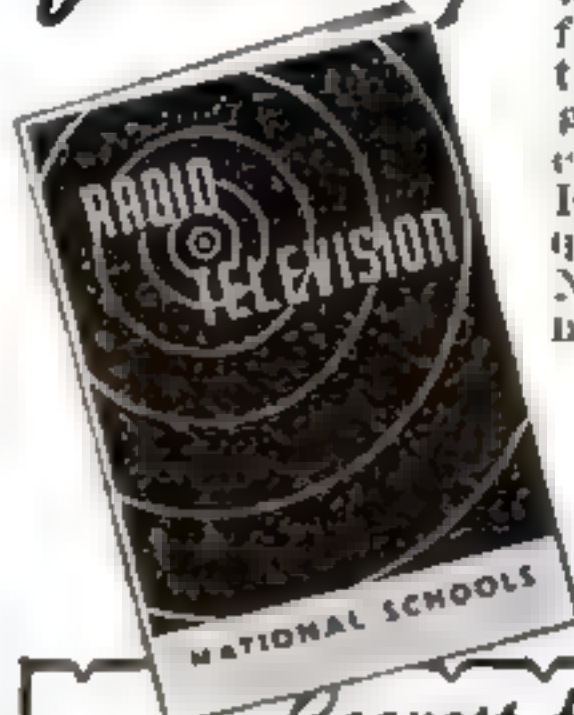
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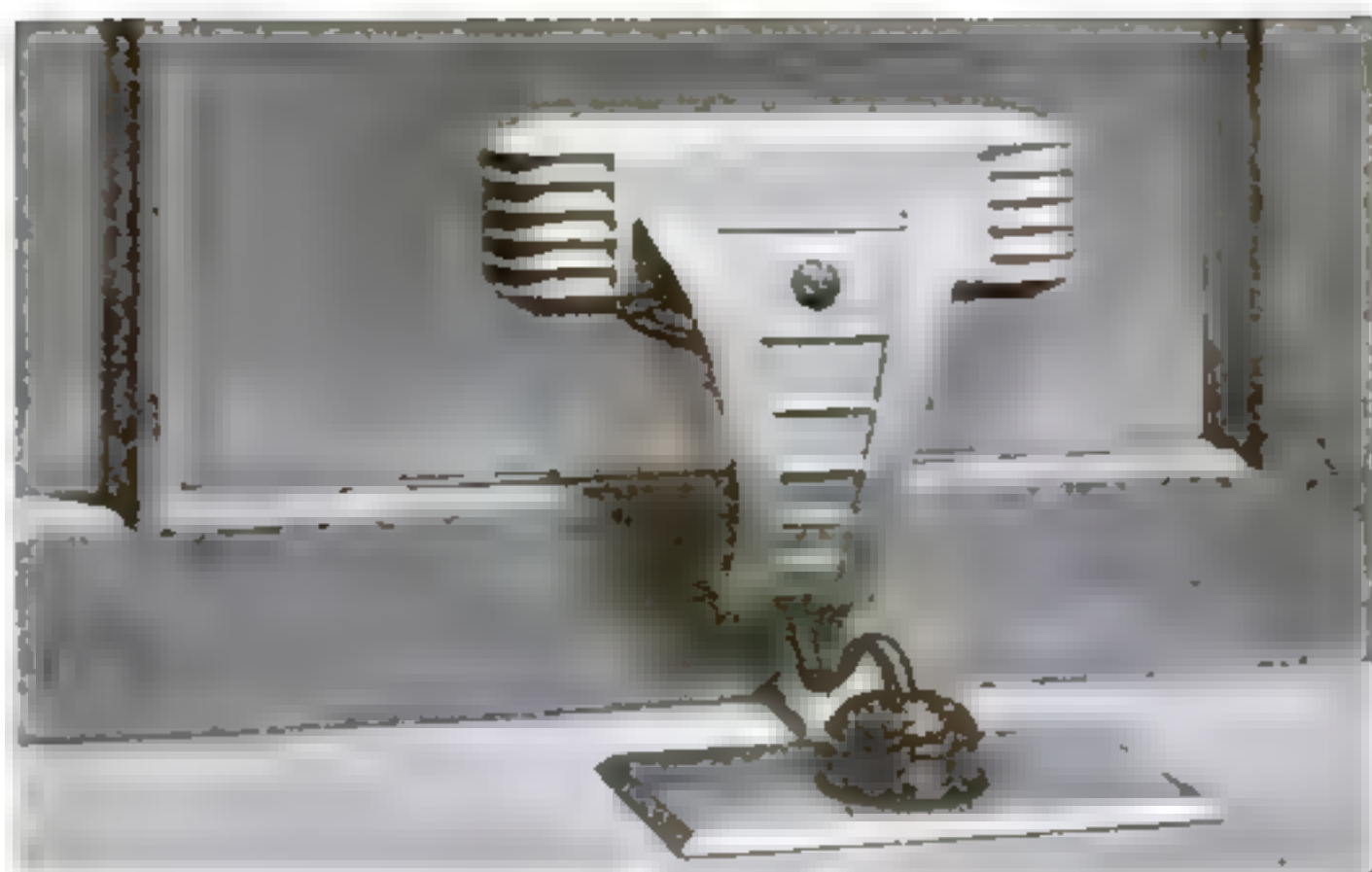
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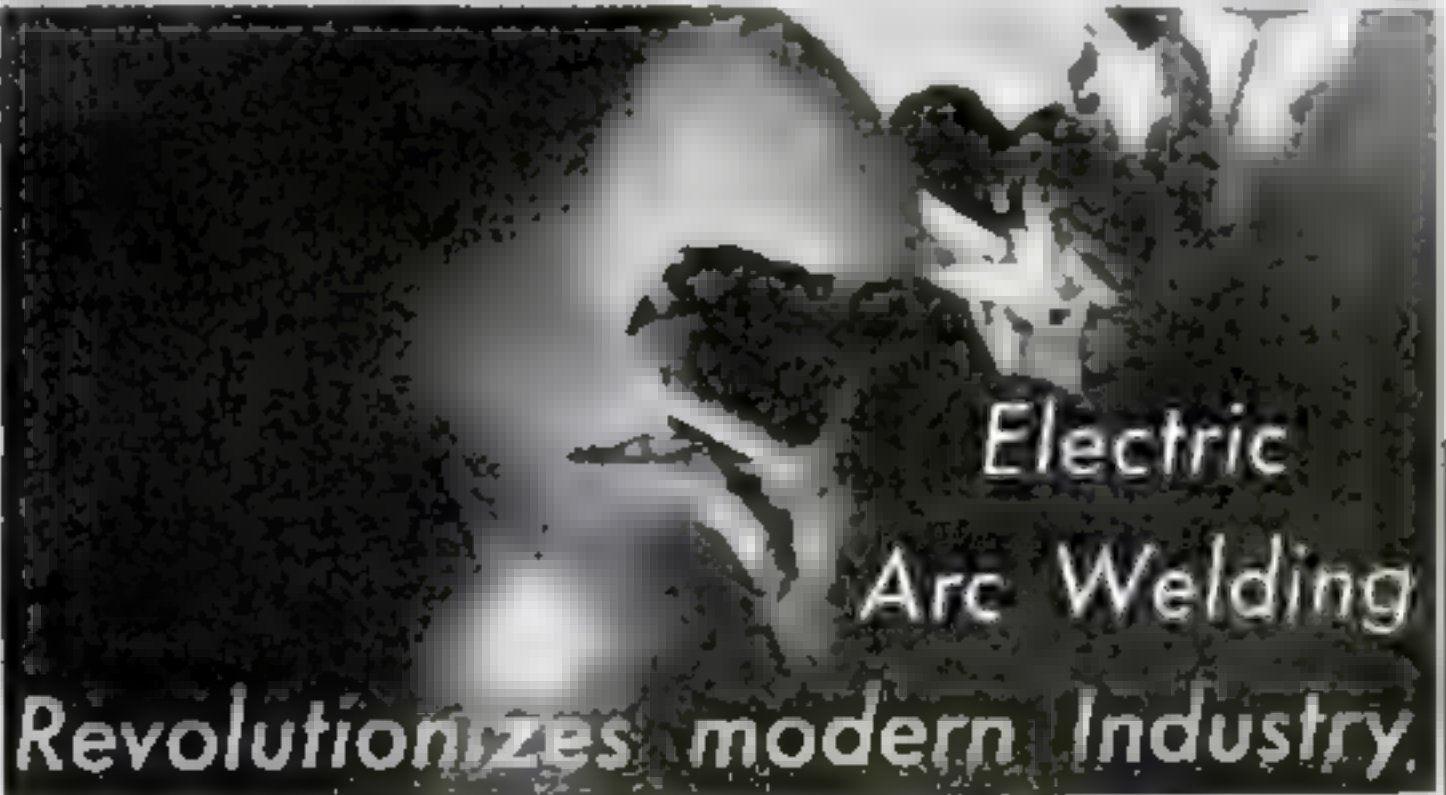
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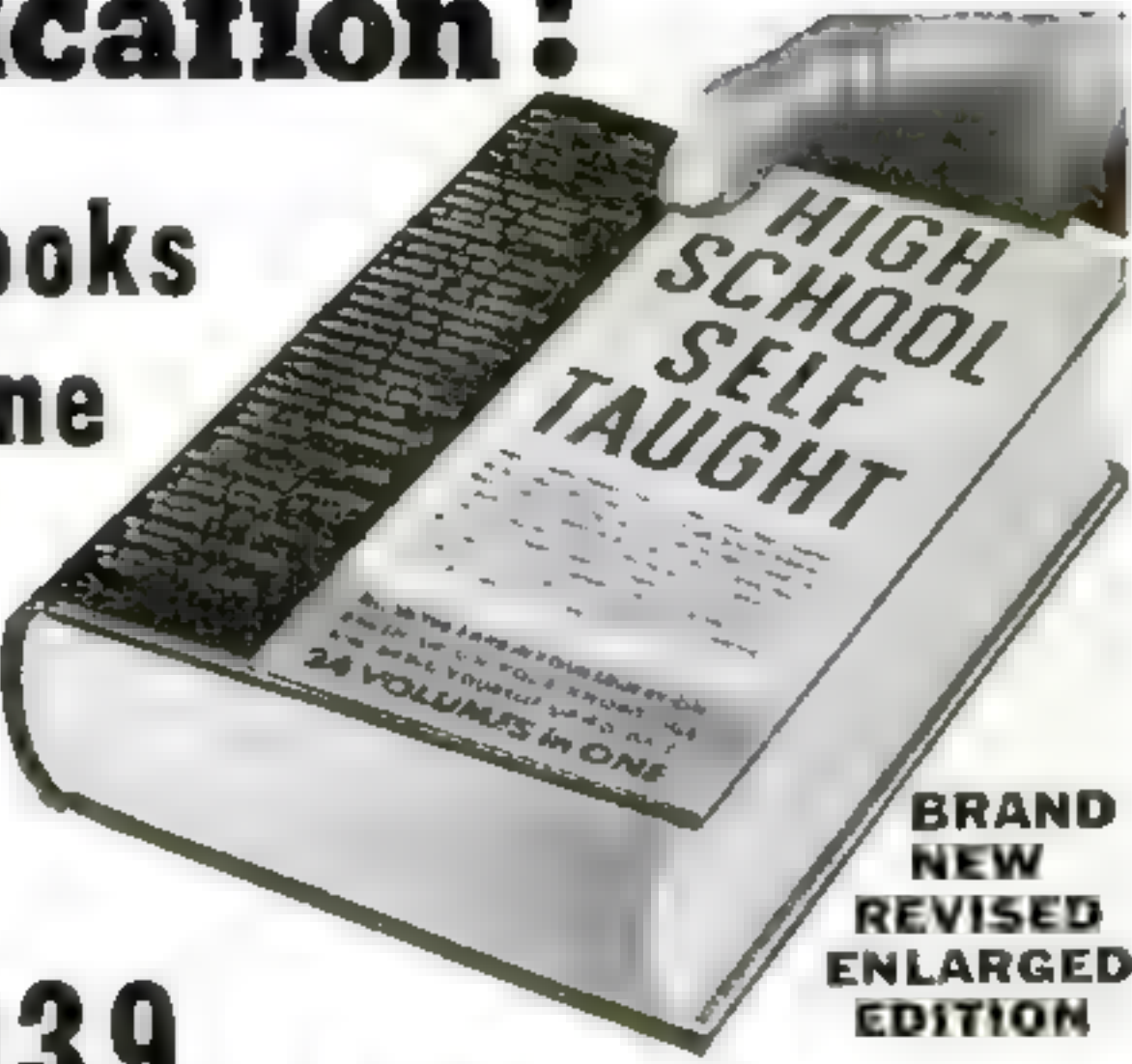
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(Continued on page 56)

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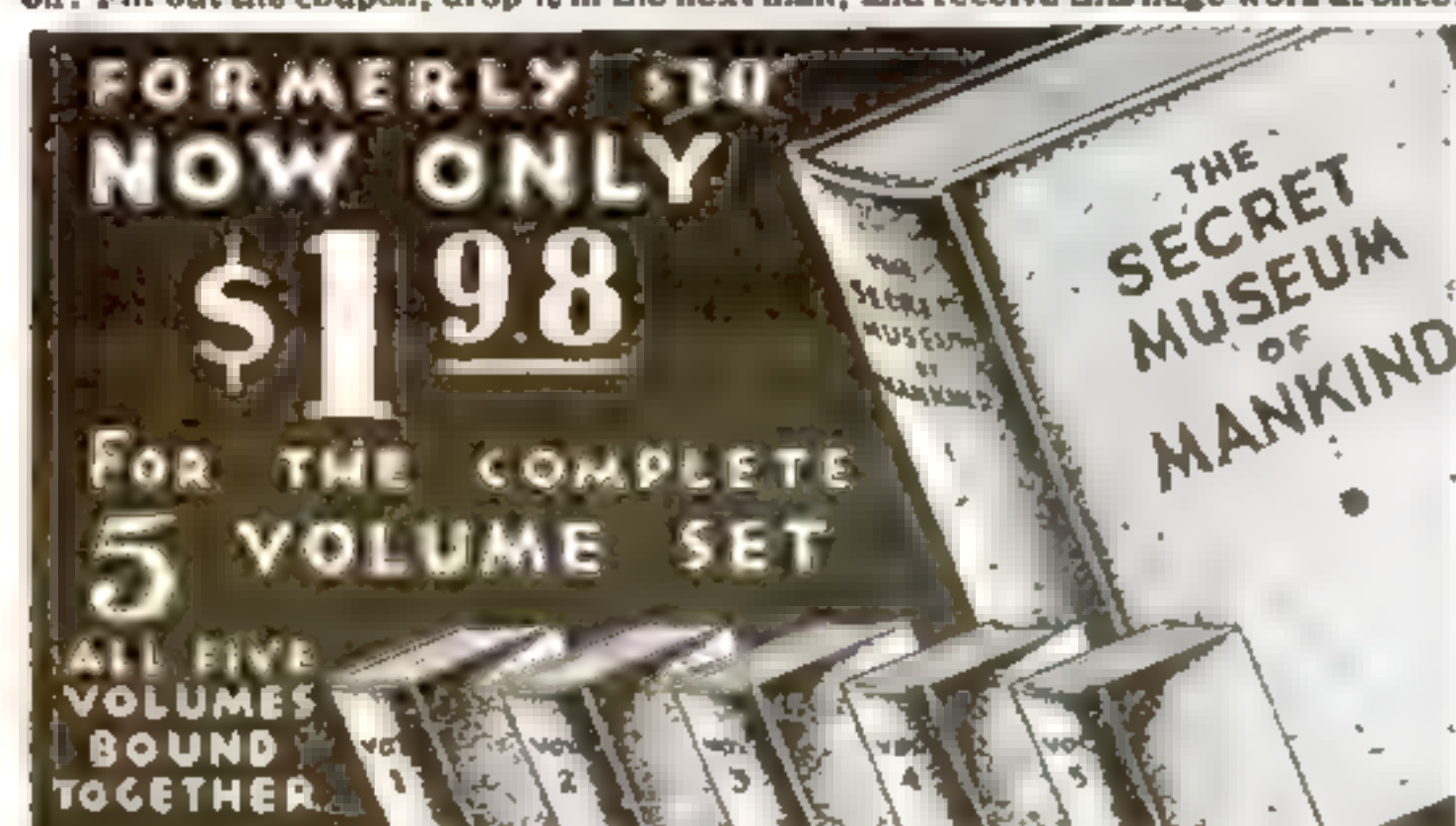
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Questions from Home Owners

(Continued from page 54)

ber gloves and apply the mix with a brush. When the paint is softened scrape off and scrub the cleaned surface with hot water. Then wipe dry and apply vinegar to neutralize any strong alkali that may remain on the surface.

Crack in Concrete Wall

Q.—I HAVE had trouble sealing up a crack that has appeared in the concrete wall of a handball court on the roof of a building. Each time it is filled, vibration loosens it and the material falls out. Can you advise me what to do to make the new concrete stay in place?
—S. H., Brooklyn, N. Y.

A.—IT IS always difficult to make new concrete adhere to old, as a perfect bond is hard to obtain. Roughening and soaking the surface to be covered is the best general plan. Keep the old concrete surface moist for about ten hours by letting a spray of water from a hose trickle over it. Then apply a pure cement paste of the consistency of cream, and place the new concrete against this. The method usually succeeds in making new concrete stick to the old.

Repairs for a Leaking Roof

W. H. L., GOWANDA, N. Y. If the roof leaks only in one place, which you can locate, it can be patched by applying a coating of thick roofing cement, adding a layer of cloth as a strengthener, and then another coat of cement. If the whole roof is bad, the best thing is to cover it with a good grade of roll roofing laid according to instructions which come with it.

Stains on Composition Shingles

Q.—THE cement-asbestos shingles on the front of our house are badly stained with a green coloring, caused by the copper screening in the windows around the top of the porch. Is there any way to remove this color?
—G. F., Baltimore, Md.

A.—IF THE stains are not too deep or extensive in area, try rubbing them with a mild acid solution such as white vinegar and water, or a two-percent solution of muriatic acid. Flush with clear water afterward. If the stains are extensive, it may be advisable to obtain a commercial shingle-cleaning agent from a local dealer in paint supplies, or from a hardware store.

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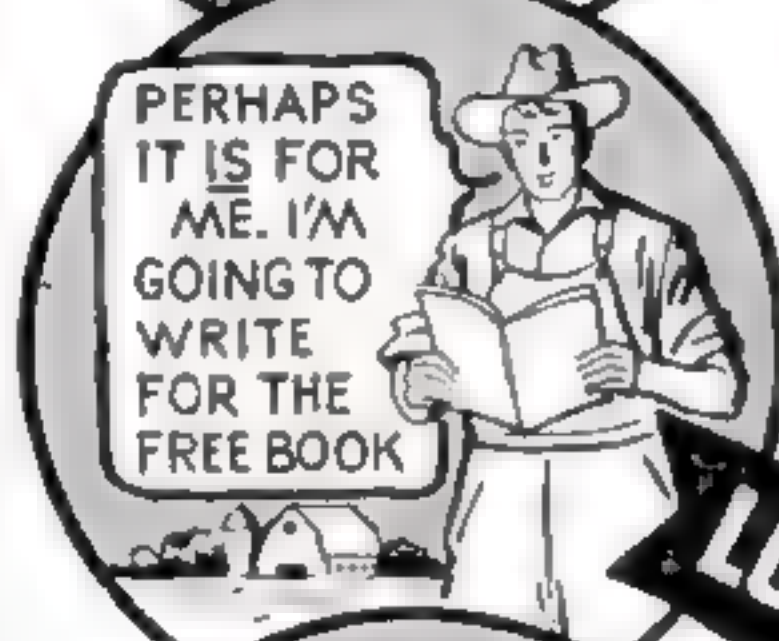
Nearly all manufacturing and construction starts on the drafting table. This means that the draftsman is one of the first to be hired and one of the last to be laid off. Drafting is a steady, life-time job that a man can keep . . . without fear of reduced wages as a result of growing old. In fact, the older a draftsman becomes, the more experience he has, the greater his earning capacity should be!

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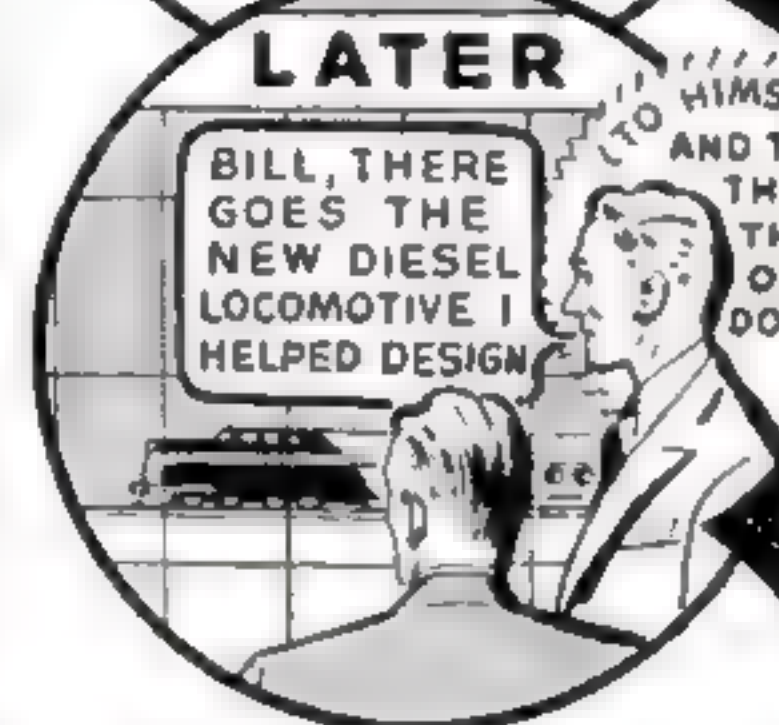


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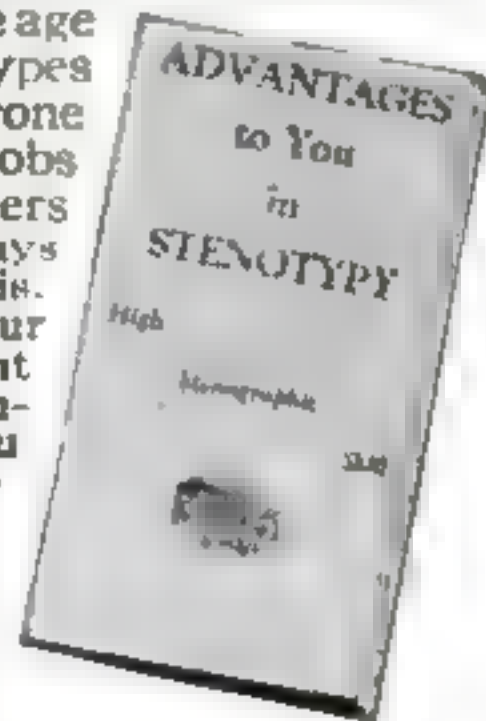
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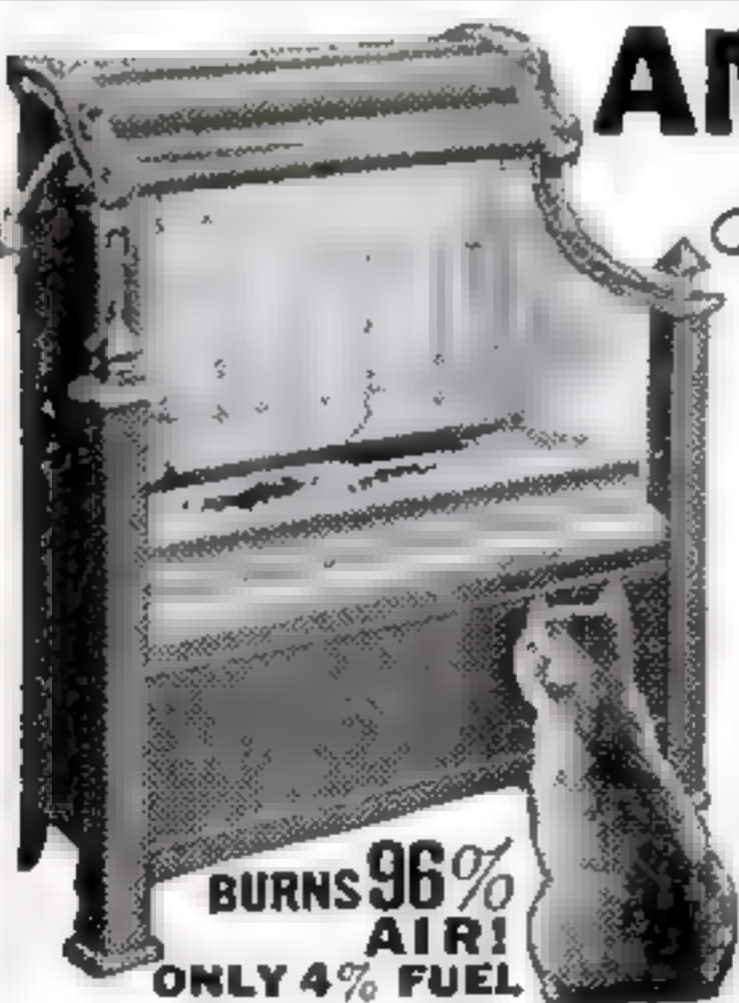
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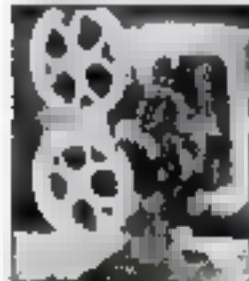
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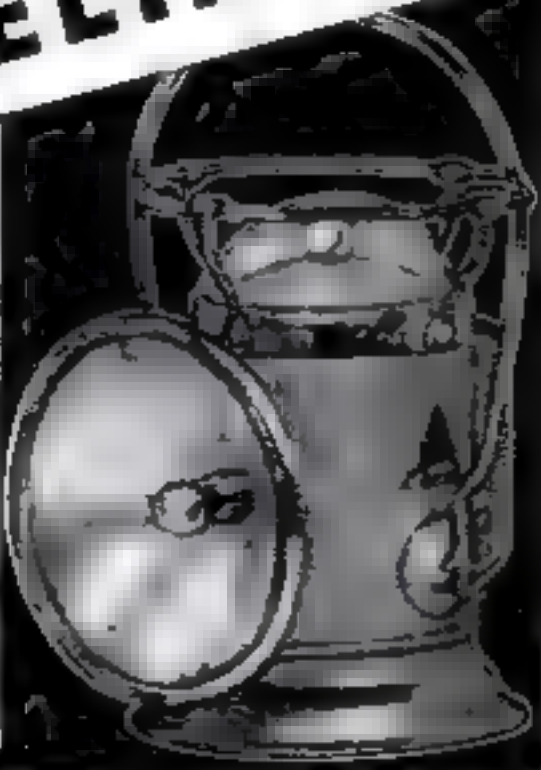
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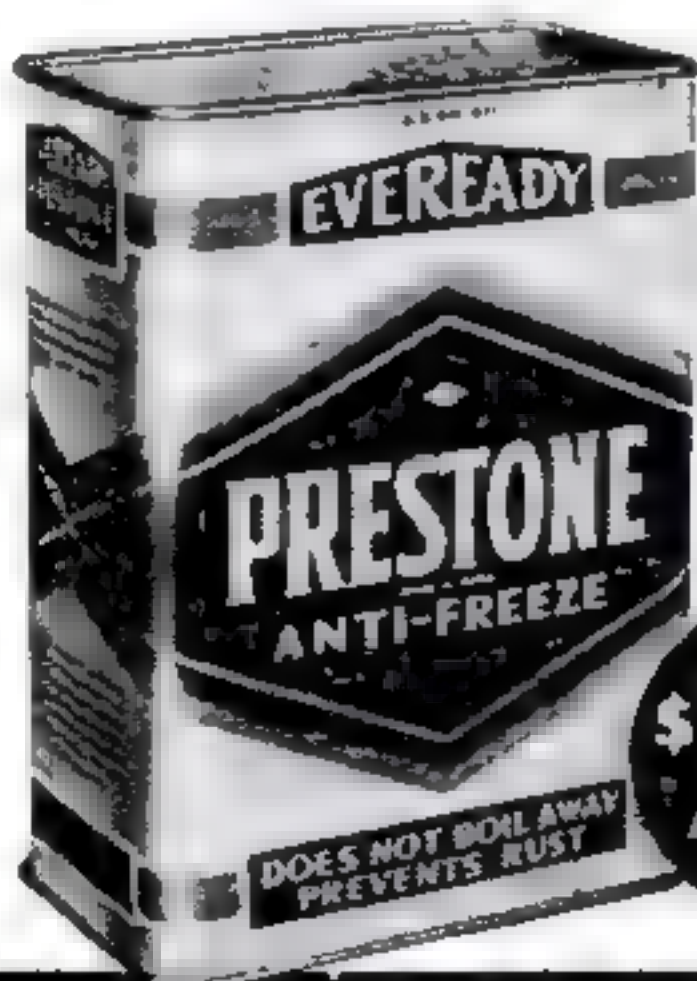
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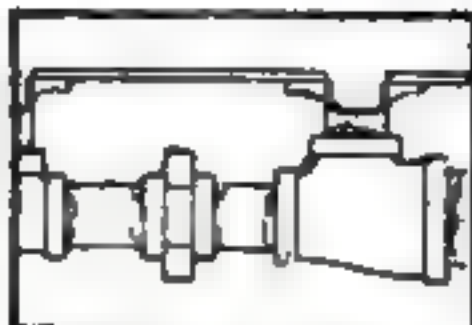
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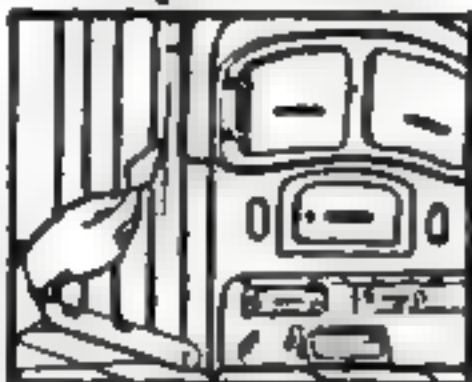
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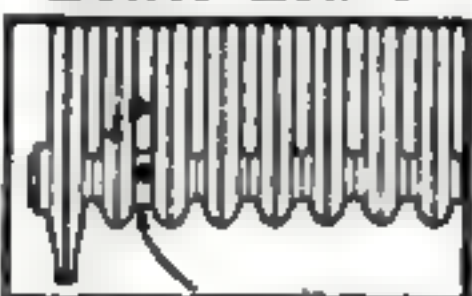
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Pipe Leaks



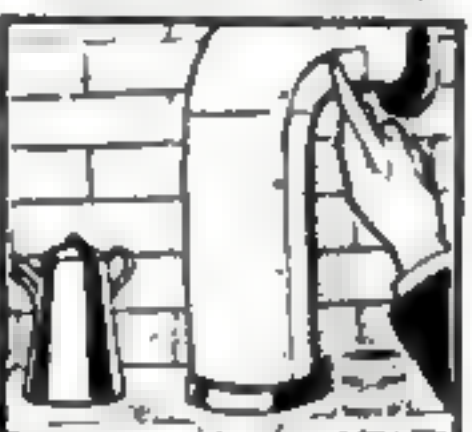
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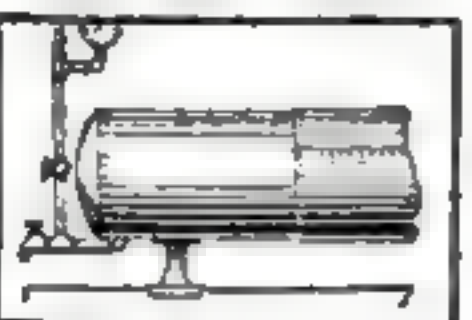
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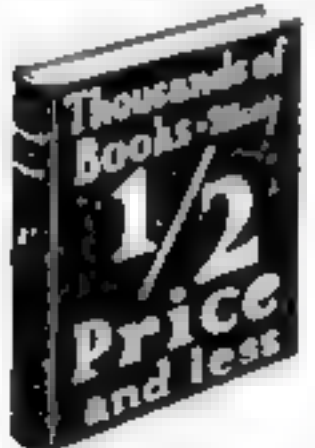


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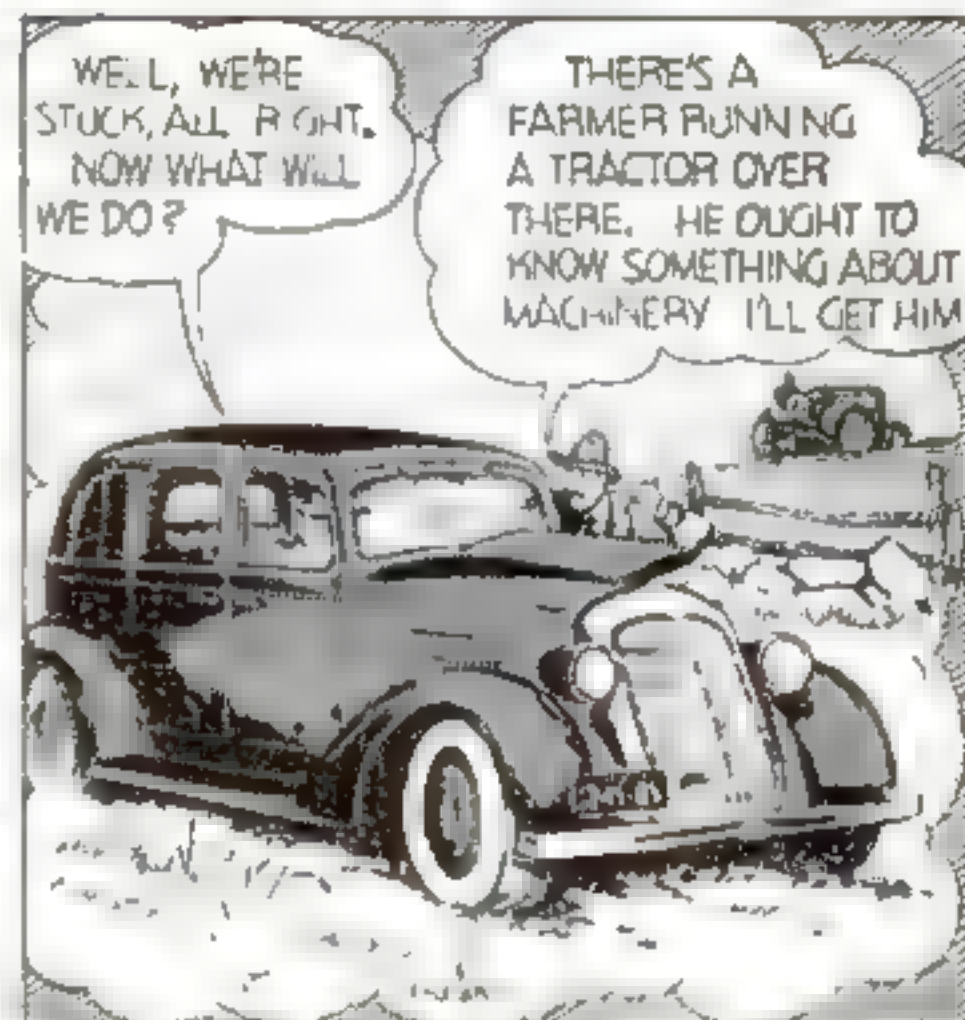
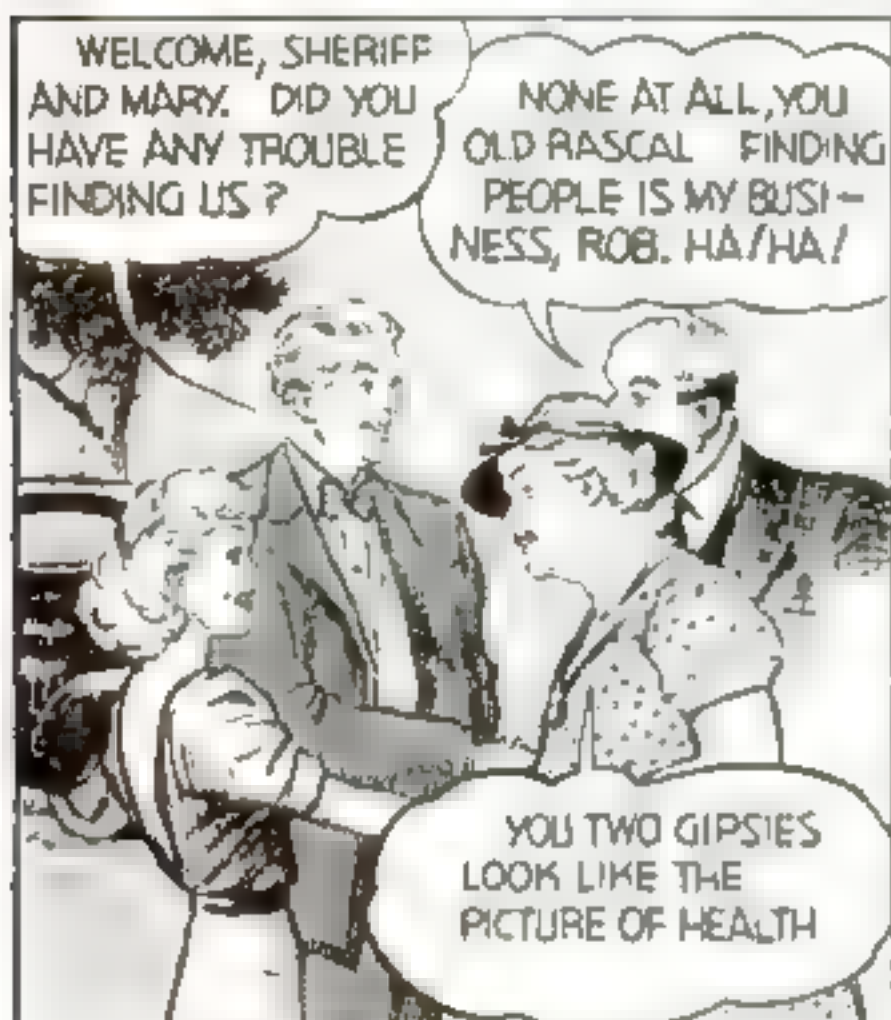
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Monthly

RAYMOND J. BROWN

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River Climbs a Mountain

TO IRRIGATE ARID PLAINS

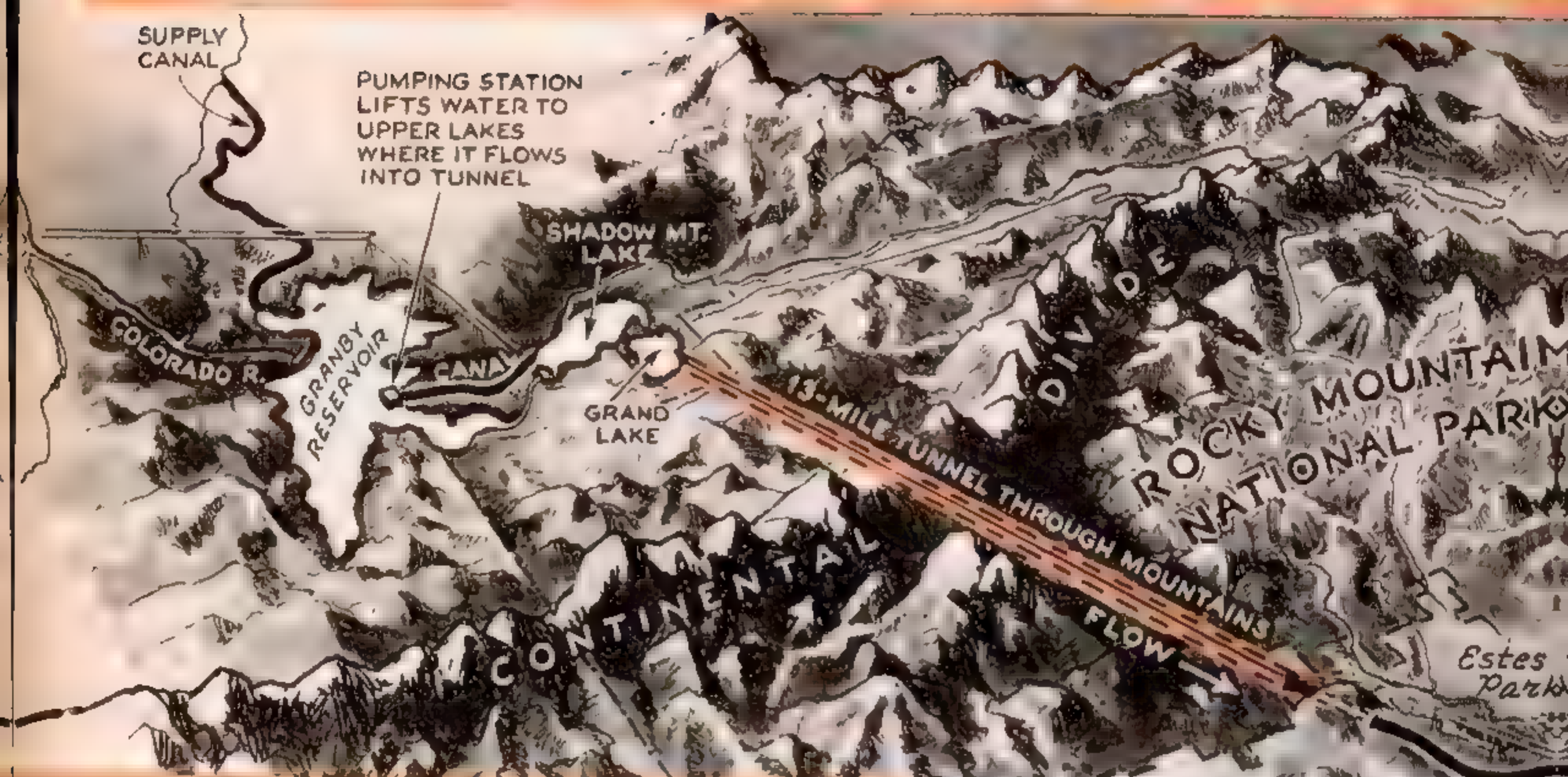
By
**ARTHUR H.
CARHART**

NORTH of Denver, Colo., in the Rocky Mountain National Park area, a great river may soon be lifting itself over lofty mountains by its own bootstraps. For engineers of the U.S. Bureau of Reclamation have just completed plans for tapping the abundant water supply on the western slope of the Continental Divide, the topographical backbone that separates the Atlantic and Pacific drainage areas of the United States, hoisting it under its own power over the mountain barrier, and spilling it down the eastern slopes to irrigate farming lands that need only water to make them as rich and productive as any in the world.

Known as the Colorado-Big Thompson project, this gigantic scheme calls for a vast mechanism of reservoirs, canals, power lines, pumping stations, and hydroelectric plants. On the western side of the divide,

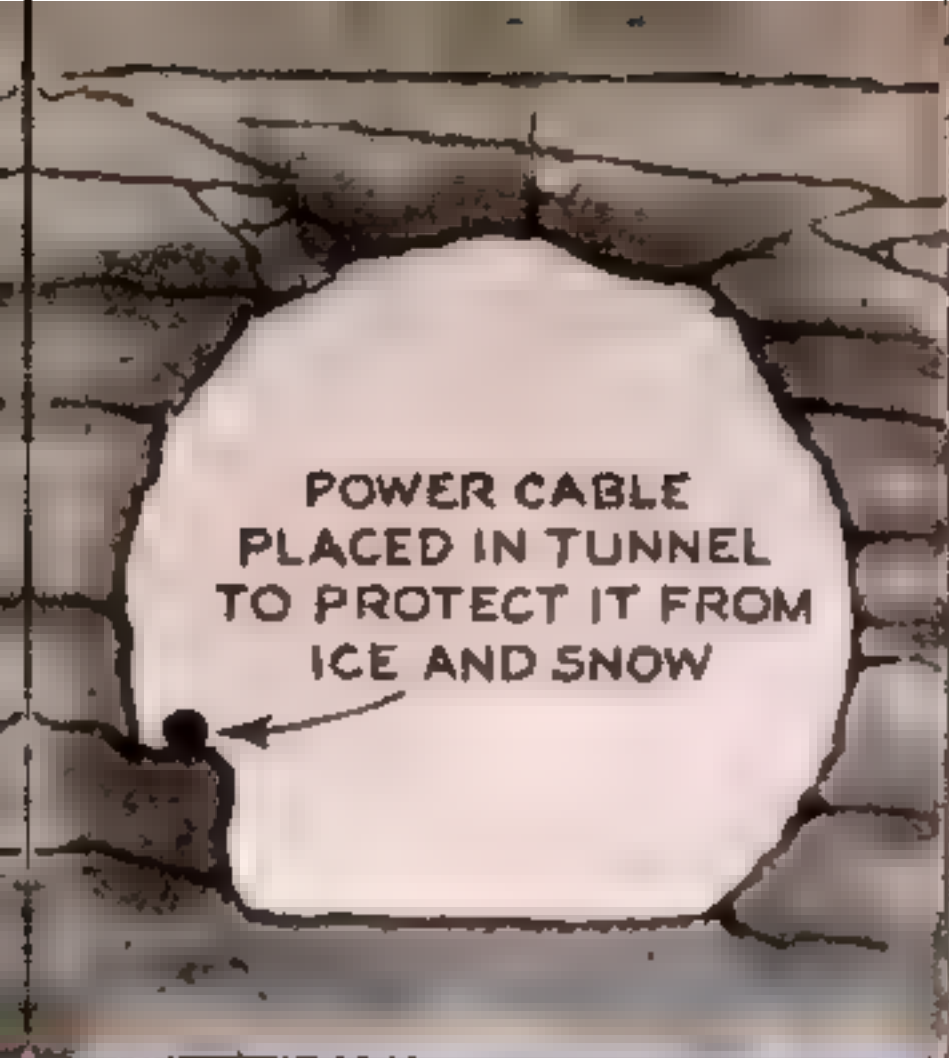


Steel spider webs like this will reinforce the concrete walls of mammoth aqueducts in the Colorado-Big Thompson project



WATER WILL LIFT ITSELF BY ITS BOOTSTRAPS

Relief map and drawings show details of the complicated system of reservoirs, pumping stations, aqueducts, and hydroelectric generating plants by means of which water from the western slope of the Continental Divide will water thirsty lands to the east. At left, steel forms being placed in typical concrete aqueduct construction



water will be taken from reservoirs on the headwaters of the Colorado River, raised and routed along a thirteen-mile tunnel bored through the Rocky Mountains, and directed down the eastern side to whirl the turbines of power generators on its way to irrigation reservoirs at lower levels. Part of the electricity generated here will be carried back to the western slopes to complete the cycle by driving pumps that raise more water to the tunnel level.

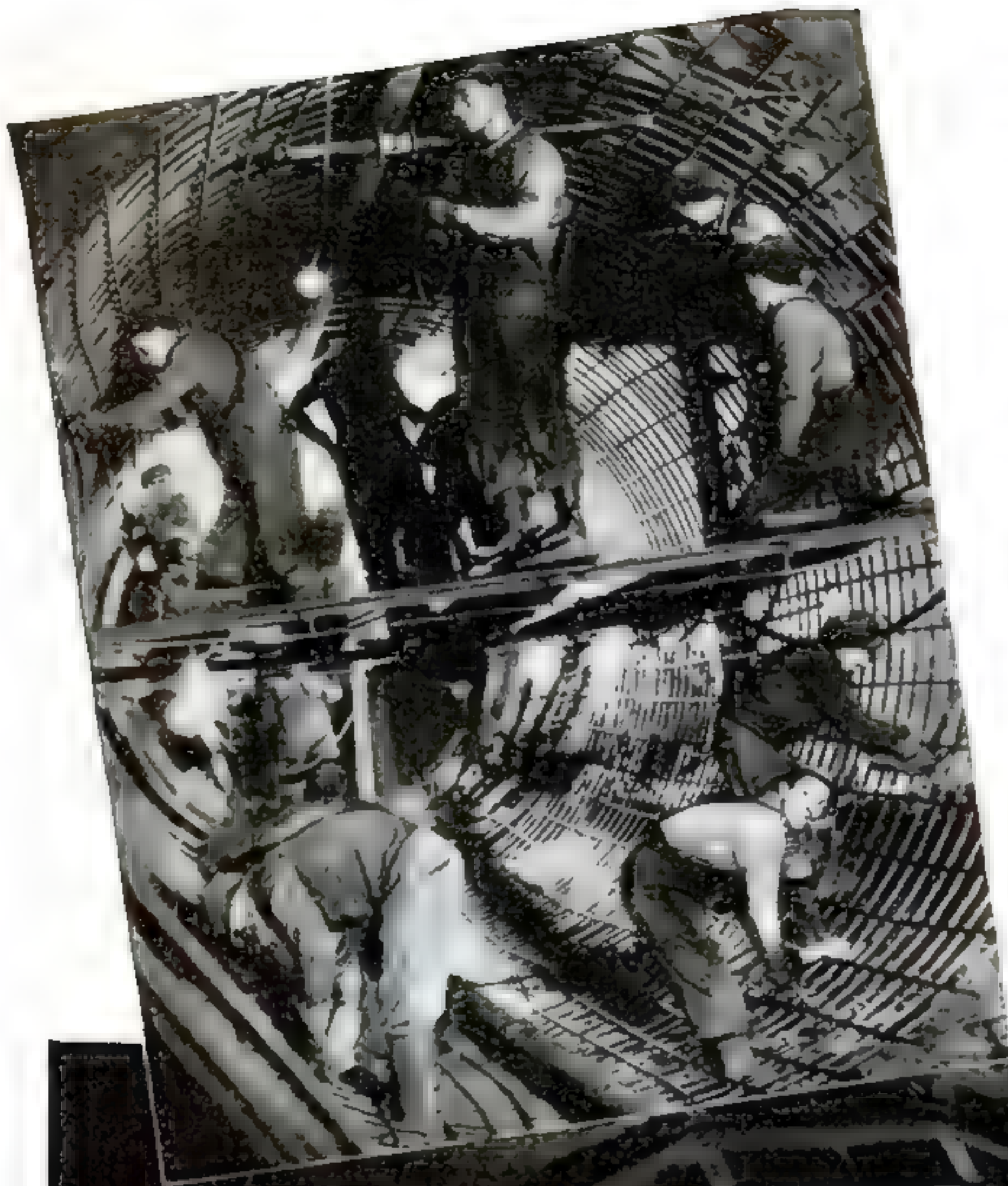
Instead of wiring this electrical energy back across the divide on towers straddling the mountains, engineers plan to pipe the 22,000-volt current back through a three-inch cable laid on a rock shelf within the water tunnel. Here the transmission line will be sheltered from the bitter cold and deep snows that would block winter maintenance work on exposed power wires running over the mountains above timber line. If breaks occur, water can be shut off and repairmen can enter the tunnel.

Another revolutionary feature of the project is the plan to keep the entire system free from ice, even when the temperature dives to forty below zero, for ice crashing down penstock tubes could do irreparable damage to turbine blades. Instead of taking water from the surface of the storage lakes that will dot the completed system, engineers plan to tap the supply at lower levels where water is always above the freezing point, even in subzero weather, due to the enormous pressure of the water and ice above.

Even in the longest open canal in the system, it is esti-



Drawing by B.G. Seielstad



mated, the running water will lose only half a degree in temperature, which it will more than recover by contact with thirteen miles of tunnel rock. Then, friction in each of the series of turbines through which it will flow will continue to replace heat that the water loses in transit from one part of the system to the next.

A giant among engineering projects, the Colorado-Big Thompson plan may change the entire character of a huge section of land, turning barren soil into fertile land, and supplying cheap electricity to light homes, run radios, operate farm machinery, and perform countless other tasks on the farms and in the nearby towns. Construction plans provide for preserving the scenic beauty of the national-park area.

Miles of steel reinforcing for water tubes will be required by the vast new river-diversion project

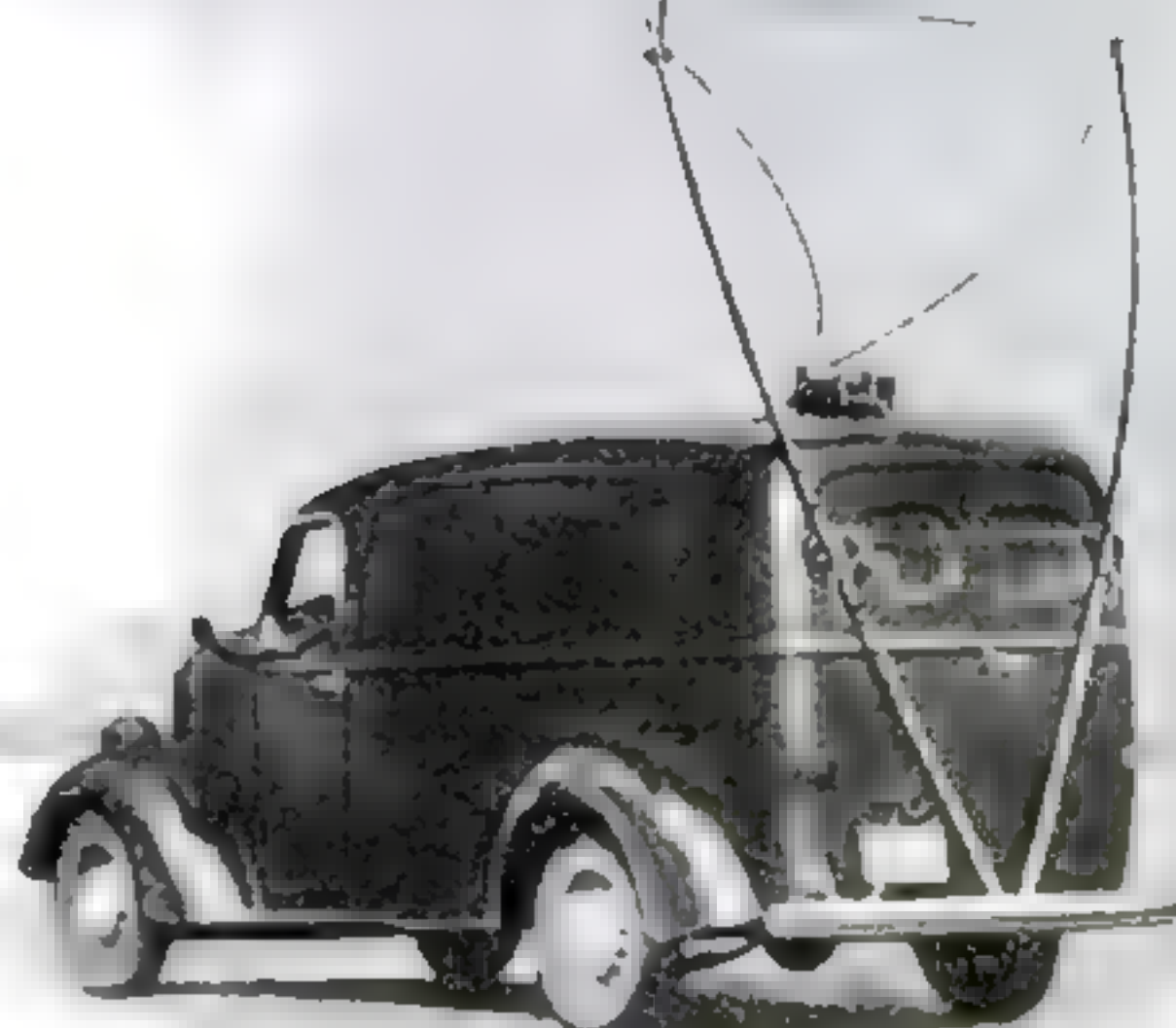


Human moles will bore a tunnel thirteen miles through the backbone of the continent. The character of the work is illustrated by this view of the main tunnel of the Gila gravity irrigation canal in Arizona



Flyers Snare Supplies from Speeding Truck

SNATCHING gasoline, oil, and supplies from the top of a speeding truck was the unusual refueling method adopted by two Ohio flyers when they recently attempted to set a new national endurance record for lightweight airplanes. When refueling was necessary, the flyers swooped low over the speeding truck, and lowered a metal hook on a line to snag cans of fuel, boxes of food, and other supplies.



Customers fairly stand on their heads to give their trade to W. B. Cutter's store

Upside-Down Store Signs Speed Up Sales

WHAT'S wrong with the store front and delivery truck pictured at the right? Knowing that it would excite curiosity and attract attention to his store, W. B. Cutter, hardware merchant of Roxbury, Mass., had his name lettered upside down on signs attached to his store and delivery car. Cutter hopes that Roxbury citizens will literally stand on their heads to give him their trade, enabling him to increase the turnover of his stock.



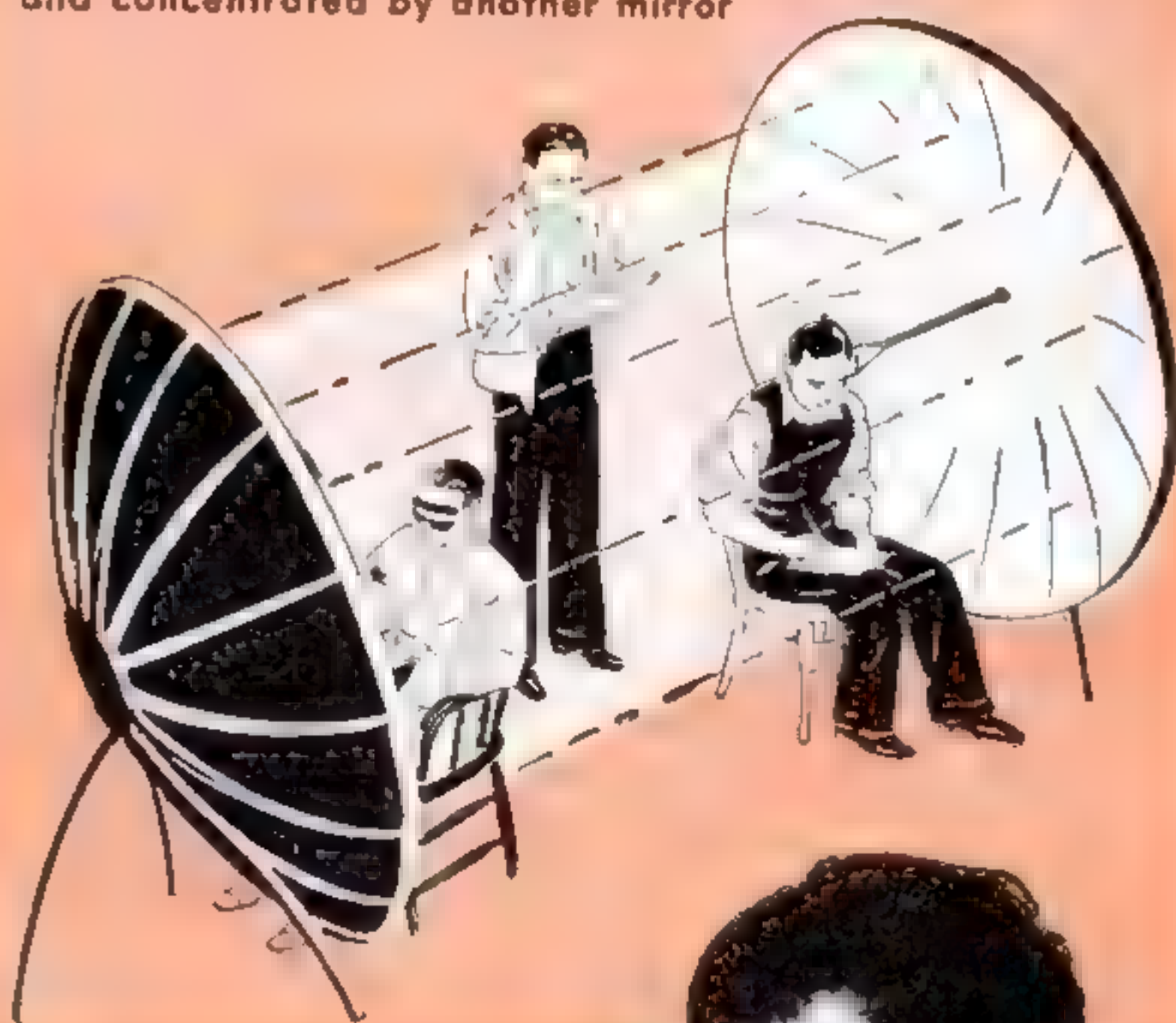
Do You

**"MENTAL SHOUTS,"
PICKED UP WITH
SOUND MIRRORS
IN NOVEL TESTS,
CAST NEW LIGHT
ON TELEPATHY**

This man is shouting mentally. Blindfolded, he is concentrating his thoughts upon the name of the paper symbol held in his hand



Involuntary sounds emitted by the subject are picked up by the sound reflector, projected across a room, and concentrated by another mirror



Dr. John L. Kennedy placing a student in position for the experiment. At the right, he is strapping pads over the ears and eyes of the subject so that the latter cannot see or hear



Think Out Loud?

WHEN you concentrate your mind on a problem, do you unconsciously think out loud? To find out, Dr. John L. Kennedy, professor of psychical research at Stanford University, Palo Alto, Calif., recently made a series of curious experiments.

Blindfolded and deafened by pads strapped over their eyes and ears, twenty-five students were led in turn to a chair placed exactly at the focal center of a large "sound mirror," a parabolic reflector designed to pick up faint sounds and project them across the room to another mirror, which concentrated the sound vibrations on the ear of a listener.

From a box, each student re-

peatedly selected a paper symbol, identified it by touch, and then concentrated on it, mentally shouting its name, although he was warned to make no actual sound. Listening carefully for mirror-reflected sounds, the receiver recorded what he believed the unseen symbol to be.

Nearly half of the subjects emitted involuntary whispers or sound cues that materially aided the receiver in identifying symbols. It was concluded that many persons do unconsciously think out loud, a fact that may have something to do with the success of certain persons in card-guessing telepathy tests (P.S.M., Mar. '37, p. 27).



Cut-out paper symbols used in the tests. They are similar to the figures employed in card-guessing experiments.



The complete set-up is seen below. As the blindfolded student identifies each symbol by touch, he shouts its name mentally and the "receiver" tries to guess what it is, while Dr. Kennedy checks results. Many were found to make involuntary noises

Mile-a-Minute Bicycles

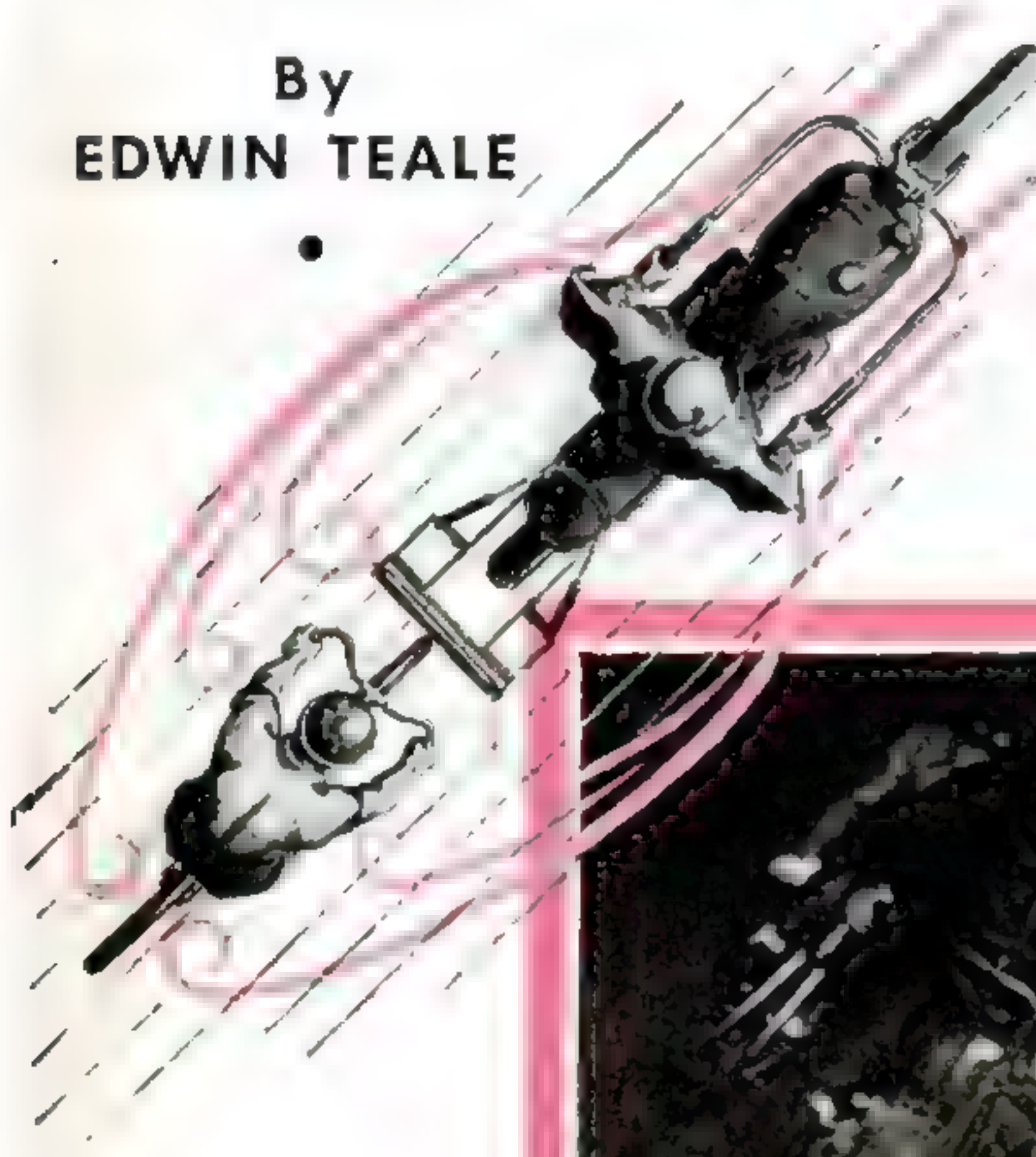
RIDE BUBBLES OF AIR IN MOTOR-PACED RACES

TWICE a week, followers of the oddest cycle sport on earth have been gathering at a gray, wooden oval on the outskirts of New York's famous amusement resort, Coney Island. On this track, with its banked turns rising thirty feet above the ground, expert riders are clinging to "bubbles of air" behind speeding motor cycles in a strange, thrill-a-minute

sport known as motor-paced bicycle racing. A decade ago, and for twenty years or so previously, such races were familiar in many parts of the United States. Today, the only track in the country featuring their thrills is the Coney Island Velodrome.

No race on wheels is stranger. Imagine yourself in the grand stand at the starting signal. Riders on curious bicycles, with front wheels smaller than rear ones and with front forks curving backward instead of ahead, begin pedaling at one end of the oval. At the same time, an equal number of motor cyclists, riding machines fitted with rollers suggesting those on clothes wringers extending out from the rear, dart around in the same direction from the opposite end of the track. Before a lap is completed, each motor cyclist picks up his bike-riding team mate, swings in front of him, and, for the rest of the race, sets the pace and breaks the wind for the rider.

By
EDWIN TEALE



CYCLING ON AIR

Air currents produced by the speeding motor cycle create a partial vacuum that whisks a bicycle racer along

Two cyclists and their pacers whizzing around a steep turn. The high speed and tricky riding make motor-paced riding a thrilling sport for the spectators, too





In this close-up, note how the pacemaker stands far back on his machine, leaning against an almost vertical seat, to give his cyclist the greatest possible advantage. He steers with extension handlebars



A motor-paced bike compared with one designed for sprint racing. The front wheel is small, and the front fork curves back

The small front wheels and reversed forks enable the cyclists to get closer to the protection of the pacemakers, while the rollers permit the spinning front wheels of the bicycles to touch the machines ahead without causing a spill.

As the machines scud past, the cyclists hugging close behind the roaring motor cycles, you notice that the pacemakers are standing

bolt upright. In passing through the air, their bodies create an area of partial vacuum behind them. Just as a newspaper follows a rushing express train, the cyclist, as long as he can cling to this area, is helped to attain speeds otherwise impossible. During sprints, motor-paced racers on high-g geared machines whiz around the track at fifty and even sixty miles an hour. Aërodynamics and athletics combine to produce the thrilling show.

Throughout the race, you hear cyclists and pacemakers shouting back and forth, planning out the moves in their game of speed. Oldtimers use tricks to save their energy for the final dash to the finish line. On windy nights, for example, veteran riders swing from one side of the roller to the other as they round the turns, always keeping on the downwind side where the partial vacuum is greatest.

Pacemakers also have their stratagems to aid the racers. They know the tricks of the game as well as the cyclists, and in many cases have been well-known bike riders before they turned to pacemaking. Before a

contest, they carefully adjust their puttees so the wind will blow up them and balloon out their leather garments. All pacemakers are required to wear the same size suits. Curiously enough, thin pacemakers offer better protection than fat ones. The explanation is that their suits flatten out in the wind instead of fitting in a snug, streamline manner. Most spectacular of the tricks of the pacemakers are those you see when the machines come tearing out of the turns. Swooping close to rivals, they seek to "blow off" opposing cyclists by breaking up the air currents around them.

The length of these motor-paced speed-battles runs from thirty to sixty-two miles. The first cyclist to cross the finish line, irre-

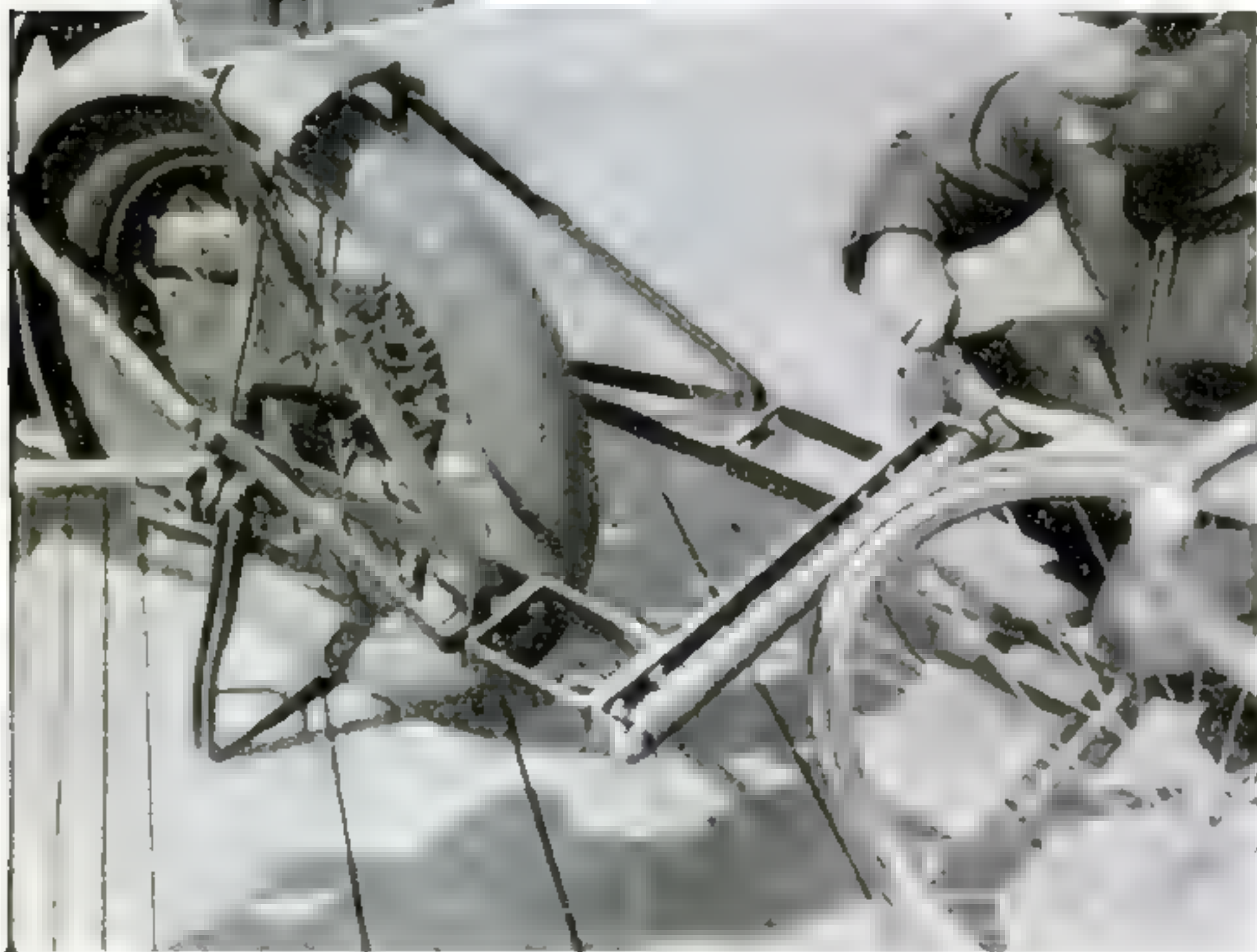
spective of the position of his pacemaker, is the winner. As the dizzy whirl continues, the front wheels of the bicycles are usually spinning within a fraction of an inch of the rollers on the pacemaking machine. Every inch the cyclist drops back increases the effort of pedaling. If he falls behind as much as half a foot, he loses his protection, his speed instantly falls off, and the pacemaker has to slow down and let him catch up. At any instant during the race, you are likely to see a leader lose his pacemaker and another rider sweep ahead of him. The uncertainty lasts to the finish line and keeps you on your toes.

The beginnings of this odd speed sport go back to the last years of the nineteenth century. Soon after 1890, records made by cyclists paced by other cyclists began to figure in the sporting news. At first, relays of wind-breaking riders led a star "pedal-pusher" in his race against time. Then, tandem bicycles did the pacing. Finally, long machines carried three, four, five, six, and even seven riders, all

Delicate adjustment of the seat is obtained by the use of a turnbuckle



Puzzle: find the bicycle rider. A front view of the team explains the whole idea—the pacemakershielding his cyclist from the wind. It helps if his clothing fits loosely



Thanks to rollers like this, mounted on the rear ends of the pacing motor cycles, racers can keep close to their pacers without too much danger of snagging a wheel—which is no fun at a speed of sixty miles an hour! Here the pacemaker is carefully checking the adjustment of the roller



Here's an old-timemotor-paced team, with two pacemakers on a tandem bicycle equipped with an auxiliary gasoline motor. This outfit was the forerunner of the motor-paced race as it was at the peak of its glory



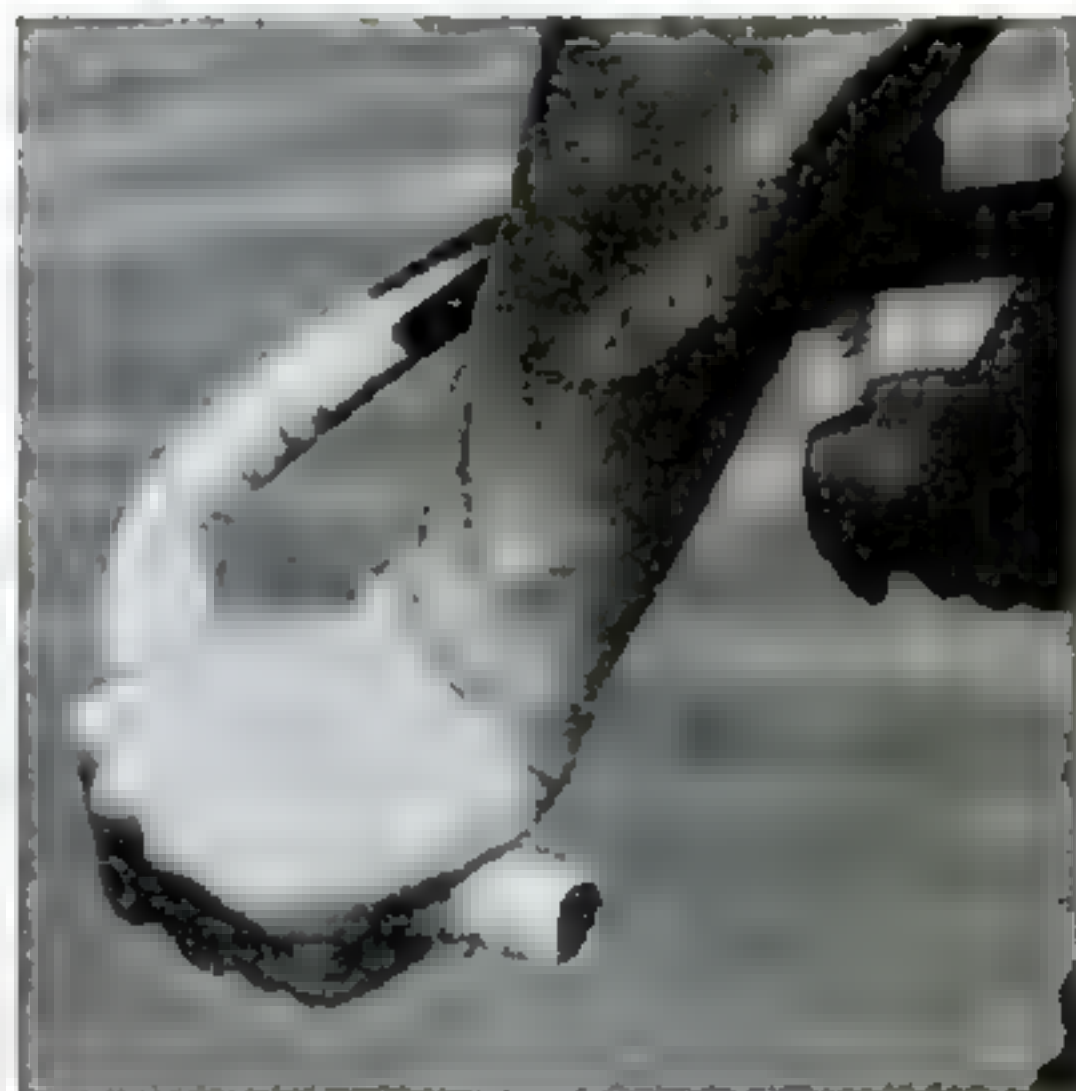
pedaling in unison with a lone racer bent low and tearing along behind.

Among the first of the motor-paced racers was Harry Elkes. In Philadelphia, around the turn of the century, he broke all existing records, paced by a tandem motor cycle on which the front rider steered and the rear rider governed the speed. After that, new records came in quick succession. Ace riders, scudding around banked tracks behind motor cycles equipped with large windshields, have set amazing marks. Leon Vanderstuyft, the Belgian, has covered seventy-six miles in a single hour at a track near Paris, France. And the Australian rider, Hubert Opperman, has chalked up a total of 860 miles during a dizzy, twenty-four-hour grind at a Melbourne bike track.

Even more spectacular were the matches between motor-paced contestants which reached their heyday in this country between 1924 and 1934. Now, at Coney Island, the remaining masters of this sport provide the only thrill races of the kind in America.



Bikes wear pants at the Coney Island velodrome. Covers protect the lightweight tires when they are off the track

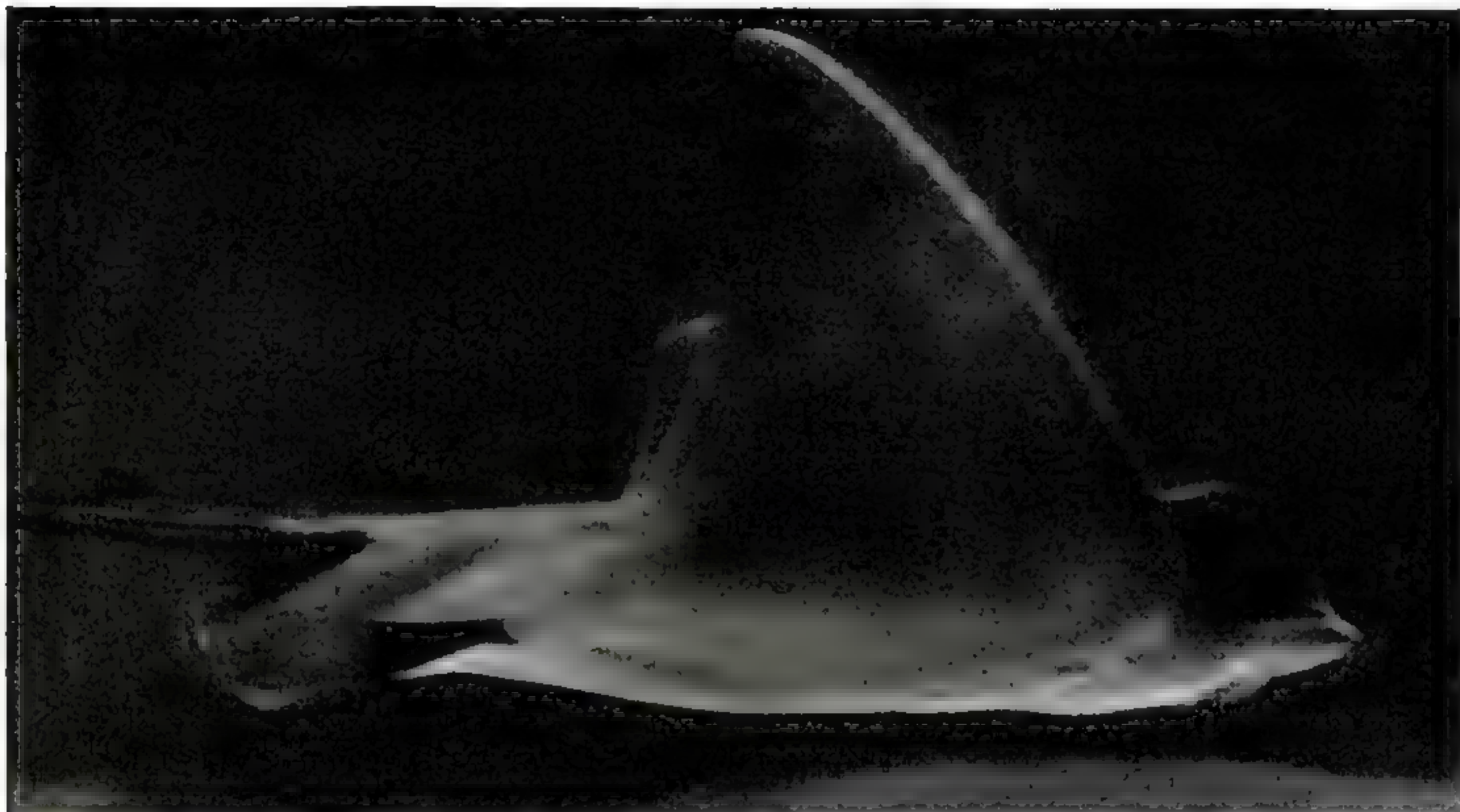


Corks stuffed into the ends of the handlebars help to prevent serious injuries in spills at high speed. The bars are taped to give a wide grip

Before motor cycles came in, bicycle riders sometimes were paced by as many as six riders on a tandem wheel. At the left is a famous "sextette" racing team back in the gay nineties



Nature's Perfect Airplane—a Fish!



Photographed broadside-on in a German aquarium, this giant ray looks like a clipper plane in flight

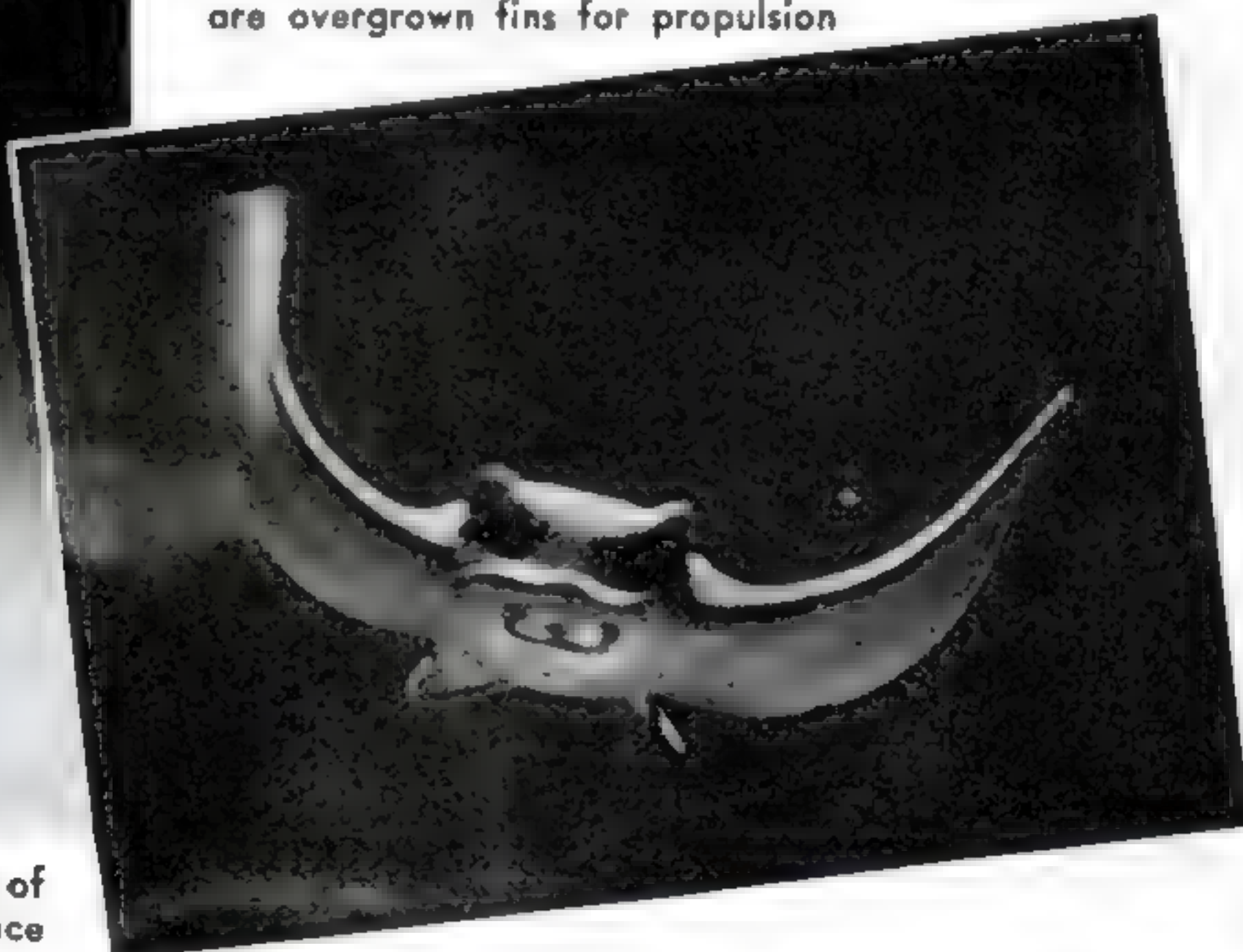
CRUISING, zooming, diving, and banking like airplanes, giant ray fish are revealed just as they disport themselves in ocean depths by remarkable photographs taken recently in a German aquarium. Perhaps no more striking pictures have ever

been made of the strange creatures than the views reproduced on this page, which show their startling likeness in motion and at rest to the plane designer's ideal of a "flying wing." Overgrown fins extending from their perfectly streamline bodies have developed into wings whose profile in cross section corresponds to the best in modern aeronautical practice. They serve not only for propulsion but also for gliding and steering. Rays dwell near the floor of the sea, where they use their curious, flattened mouths to feed upon mollusks and crustaceans.

Below, a head-on view. The "wings" are overgrown fins for propulsion



The kite of the sea. The mouth and eyes of this variety strangely resemble a human face



Her Name Is at Her Fingertips

DISPLAYING her name on her finger nails by painting one letter on each nail is the odd style affected by Helen Wood, Hollywood film actress, who is pictured in the photograph reproduced at the right. A single letter is painted on the nail of each finger with a white liquid that stands out in marked contrast to the dark-red background formed by a deep shade of nail polish.

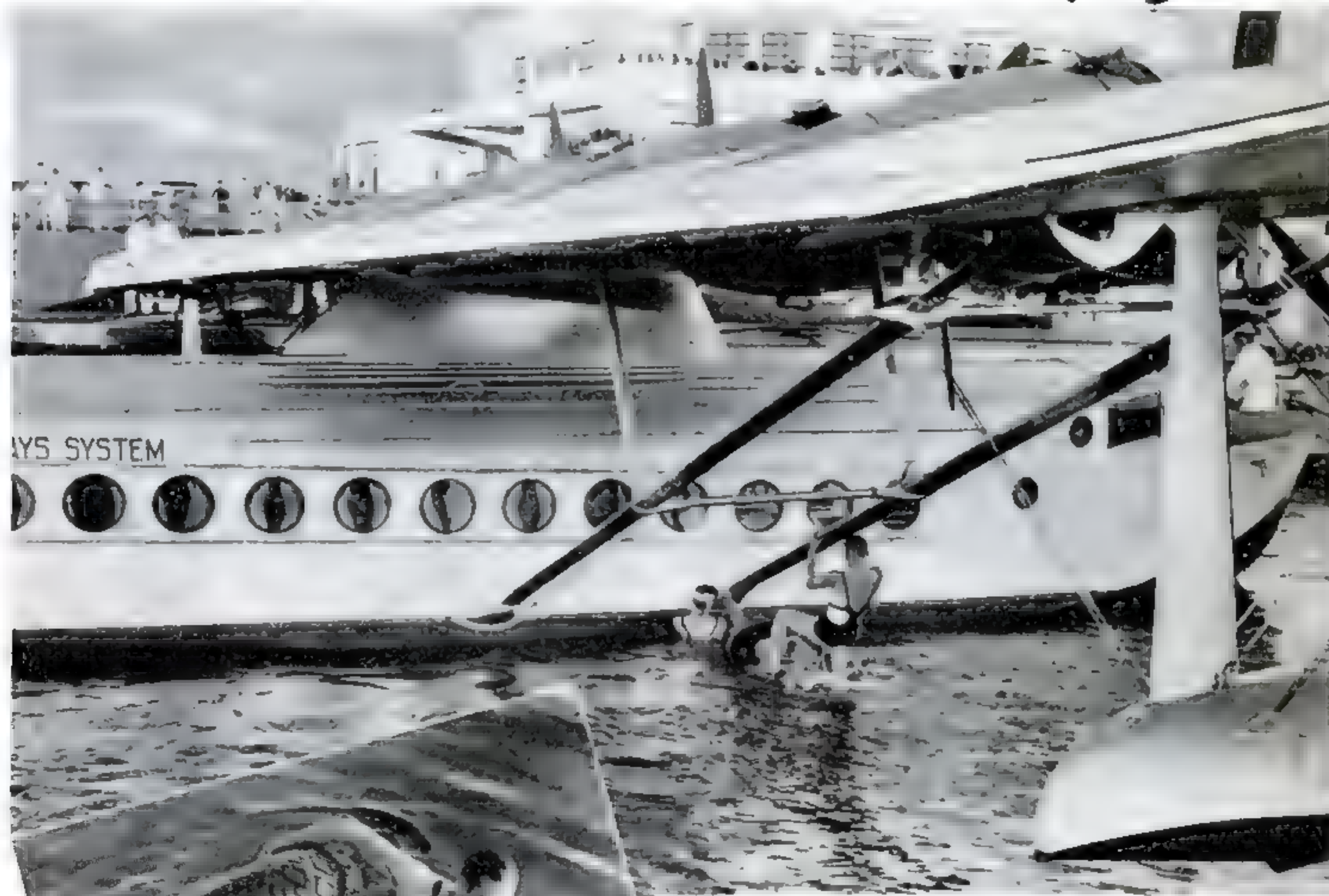
Sighting Device Aids Bombers

VERTICAL-DIVE bombing by airplanes is made more accurate and deadly by an improved gyroscopic sighting device recently invented. Instead of squinting through an eyepiece to find the true vertical direction, as was necessary in earlier devices, a pilot has only to glance at the ground through a viewing screen. A bright spot of light on the glass shows the true vertical direction, regardless of the position of the plane.



This is Helen Wood, film actress. If you don't believe it, read her finger nails

Ground Crew Takes to Water To Dock Flying Boats



Swimmers putting wheels on a clipper ship. Inset shows one in water

EXPERT swimmers are members of the "ground" crew that docks Pan American Airways seaplanes alighting on the waters of Biscayne Bay, Miami, Fla. When a clipper ship lands, swimmers tow out wheels and tires, and attach them to the plane so that it may be rolled out of water and maneuvered on land for servicing and overhauling. Members of the marine crew make frequent dives to tighten bolts.

Rocket Works Like Machine Gun

SEEKING to establish a new altitude record for rockets, John W. Parsons and Edward S. Forman, astronautical scientists associated with the Guggenheim-California Institute of Technology rocket-research project, have recently perfected a novel rocket that works like a machine gun. A special mechanism fires and reloads with a succession of gunpowder cartridges at the rate of about ten a second to drive the rocket aloft. Between 100 and 200 cartridges will be used for each flight of the projectile.

Experimenters trying out a model of their long-range, multiple-explosion projectile

Lime Kills Starfish To Save Oysters

CHEMICAL warfare, in the form of a barrage of quicklime rained on the ocean bottom, may help to eradicate destructive starfish from oyster beds. Tests by U.S. Bureau of Fisheries experts indicate that particles of lime falling on starfish destroy their skin membranes, expose the internal organs, and so produce death, without seriously harming the oysters.

Portable Device Gauges Dust

ACCURATE estimation of the concentration of airborne dust in mines, factories, and other places remote from a laboratory is made possible by the portable electric device shown at the right. Magnified images of dust particles drawn into the apparatus are observed on an illuminated slide marked off into squares of equal size to facilitate counting of the motes. A long attachment cord permits the device to be used 100 feet away from an electric outlet.



Portable dust counter in use. It is plugged into an electric outlet

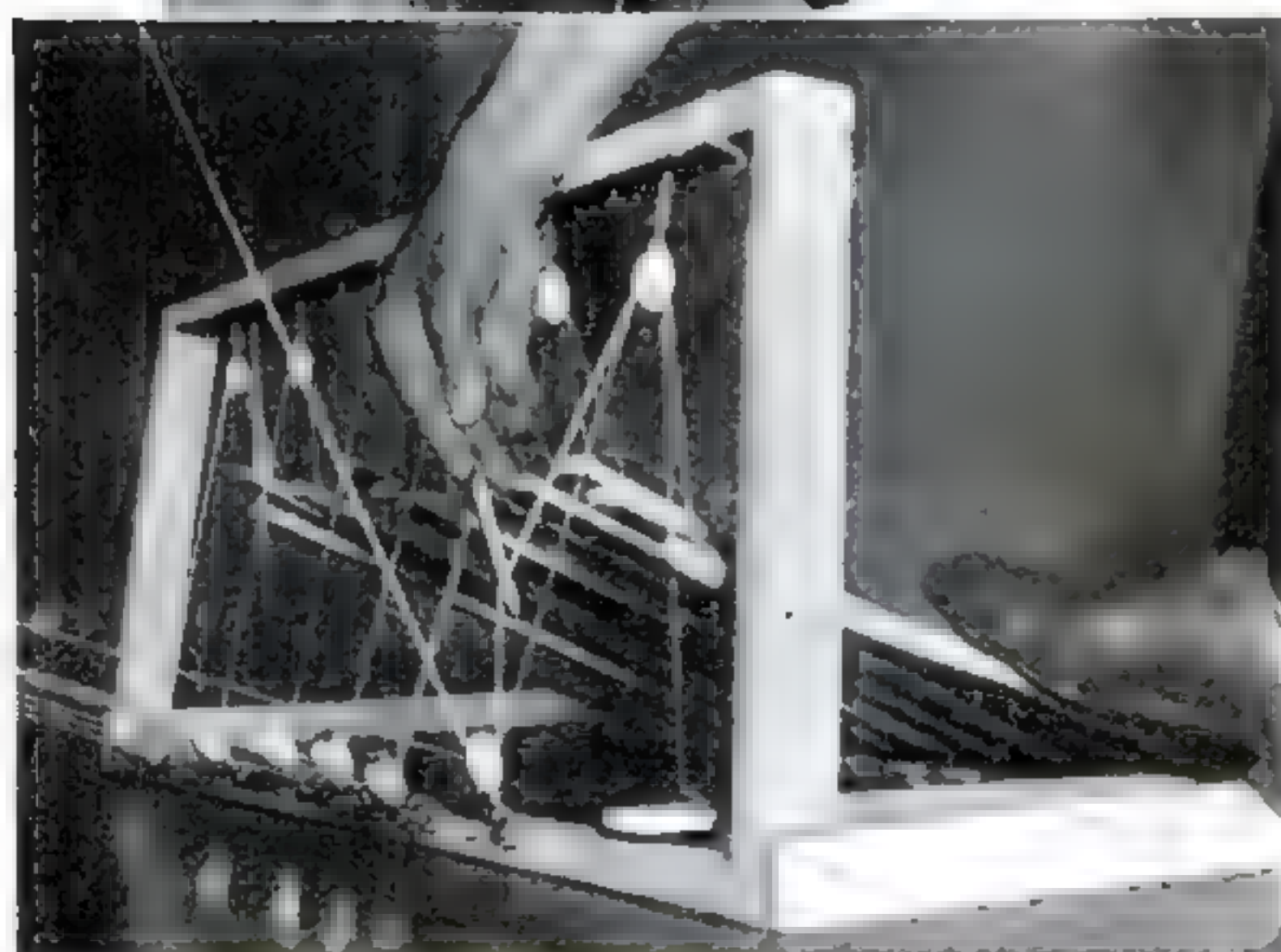


Rubber Toy Balloon Makes Radio Kiss

TO SIMULATE by artificial means the sound of a kiss for broadcasting purposes in romantic radio dramas, sound engineers at an Atlanta, Ga., station use an ordinary rubber toy balloon. As pictured above, the kissing sound is made by drawing the fingers across the surface of an inflated balloon held close to the microphone.

Surgeon Photographs His Own Operations

Dr. James Stotter performing an operation under the eye of his specially controlled camera. The pictures below show how pedals and cords operate the shutter and change the film



BY CONTROLLING a camera with an ingenious system of foot pedals, Dr. James Stotter, New York City plastic surgeon, makes a permanent record of all the operations that he performs upon his patients. Setting up his film-pack camera upon a tripod about thirty inches away from his operating table, he focuses it in advance upon the spot where, for example, he will remodel a patient's nose. The base of the table incloses a homemade wooden frame with thirteen hinged slats, connected to the camera by lengths of stout fishing line running over pulleys. Stepping upon the pedal at the extreme left snaps the shutter to make an exposure. The other pedals shift the film in the pack, pulling the tabs in proper order until all twelve films have been exposed. A piece of adhesive tape attaches each tab to its proper cord. Thus the surgeon need not turn from the patient and pull the tabs by hand, in order to record the successive stages of the operation; and the foot-operated controls make it easy for him to snap a picture at will, while leaving both his hands free for his work.

Long-Range Camera Gets News Pictures



Focusing the long-range camera unobserved from outside an estate

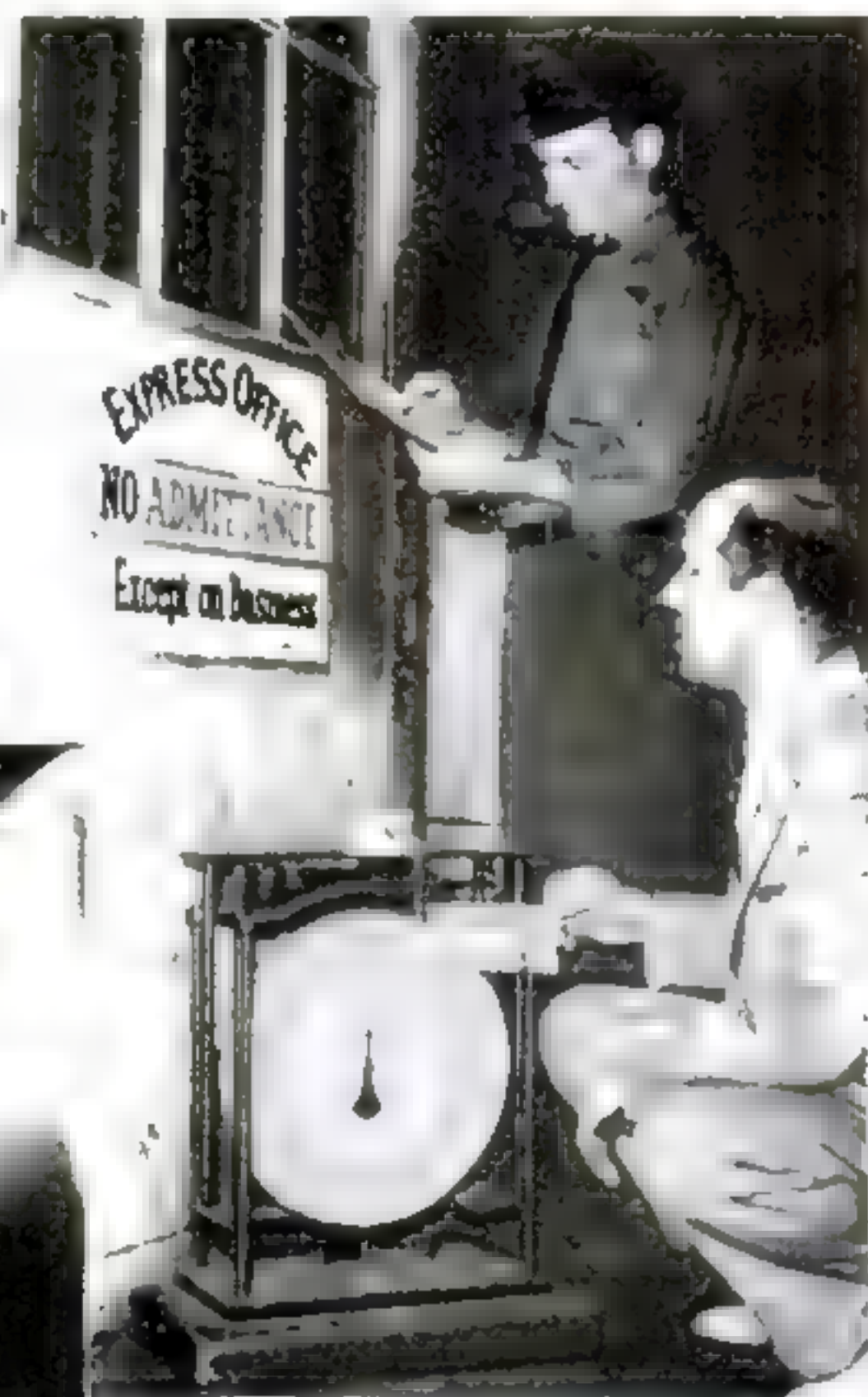
WITH the aid of a stepladder and some timely "head-work" on the part of an assistant, an English news photographer was able to train his long-focus, telescopic camera on persons walking through the grounds of an estate from which reporters and cameramen had been barred. The photograph at the left shows the photographer focusing his long-range camera as it is supported by the head of his assistant.

Torpedo Misses — Tries Again

WHEN a new-type torpedo passes in front of its enemy-ship target, a wire trailing behind the torpedo is touched by the ship's bow, closing a contact and causing the torpedo to turn around for a second try. The direction of the turn is predetermined according to the way the target is moving.

Flea Actors Hop to Hollywood

TRAINED fleas owned by Roy Heckler of New York City and booked by a Hollywood motion-picture producer for featured roles in a film now in production, were recently rushed across the continent by airplane to report for duty on the set. Before the mass flea flight, the insects were carefully weighed to determine transportation charges, as shown at the right, and given a bon-voyage meal on the arm of their trainer, as below.



Fleas getting a bon-voyage meal before hopping off. Above, they are weighed for the plane ride

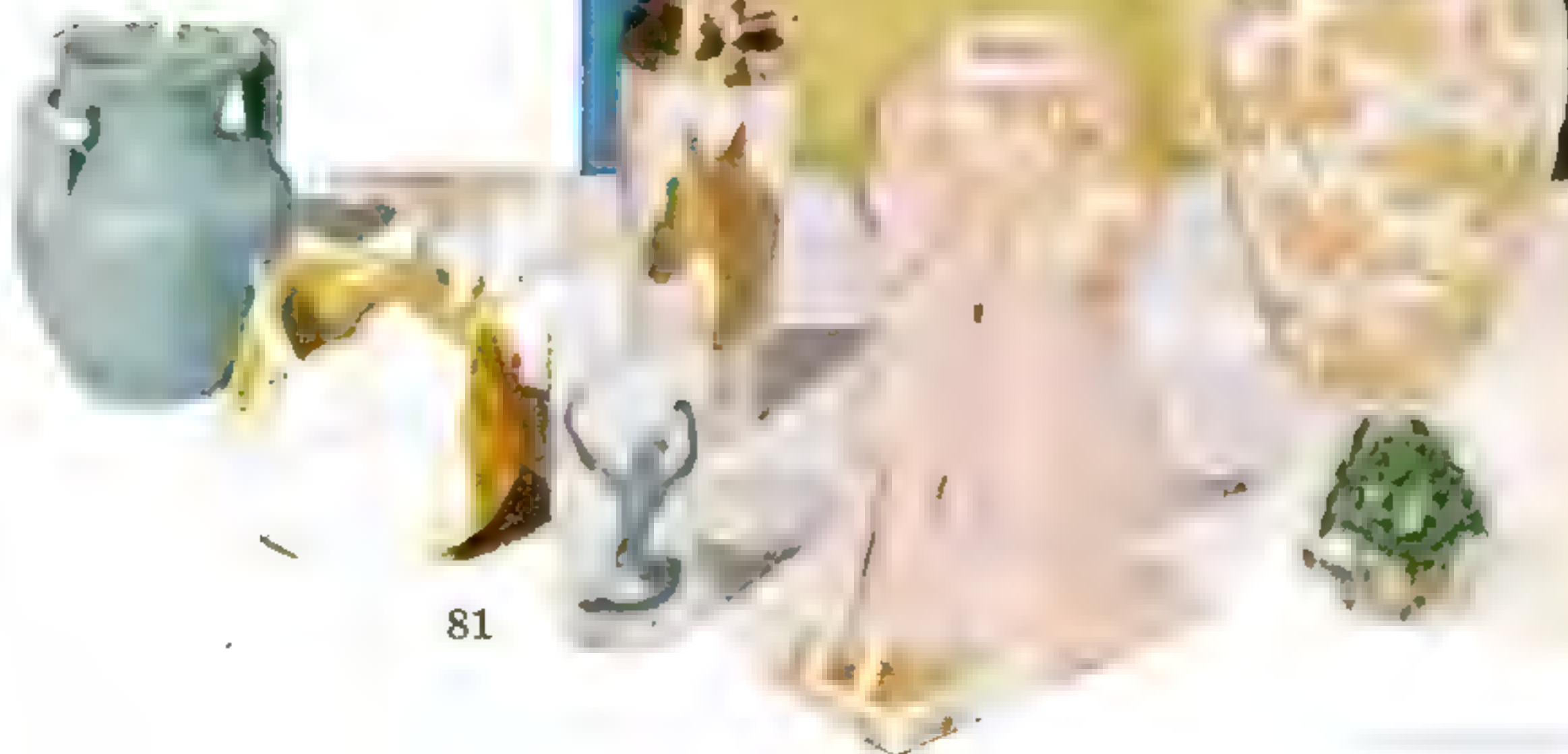


In these ball mills, minerals for coloring ceramics are ground to powder by tumbling with porcelain balls

Rainbow Makers

**COLOR WIZARDS
CREATE NEW HUES
FOR POTTERY**

More than 15,000 different hues for pottery, glassware, china, and other ceramic products have been evolved at a Du Pont laboratory at Perth Amboy, N. J. The photograph at the right shows some of the delicate tints that add beauty to modern homes



A furnace in which oil-fed flames create temperatures as high as 3,000 degrees F., to smelt coloring minerals. The workman is using an optical pyrometer to measure the heat. Below, a rainbow in ceramics—some of the thousands of tints from the odd laboratory



Color Photographs Made Specially for Popular Science Monthly

By JOHN E. LODGE

OVER the door of a red-brick building on the waterfront at Perth Amboy in New Jersey, you might put this sign: "The Home of the Rainbow." For within its walls, color wizards of the Du Pont Ceramics Laboratory are kept busy the year 'round imitating nature's rare colors. Like artists mixing oil paints, they carefully blend metallic pigments to concoct exotic colors that bring new beauty to your glassware and to pottery vases, tiles, and the many other baked-clay articles that come under the general heading of ceramics. Already they have created more than 15,000 different hues, and each year sees almost 1,000 more added to the list.

In ancient times, craftsmen had at their disposal only a few materials for use in coloring their glass and pottery. Today, prospectors search the four corners of the earth for the 1,000 or more ingredients employed at the Perth Amboy laboratory. Cobalt from South Africa, antimony from China, translucent cryolite or "ice rock" from Greenland, titanium from India, and borax from Death Valley in California, all go into the making of the dazzling range of ceramic hues. Precious metals, and even the rare radioactive metal uranium, are being pressed into service to yield richer shades.



As the first step, a vase is shaped on a potter's wheel



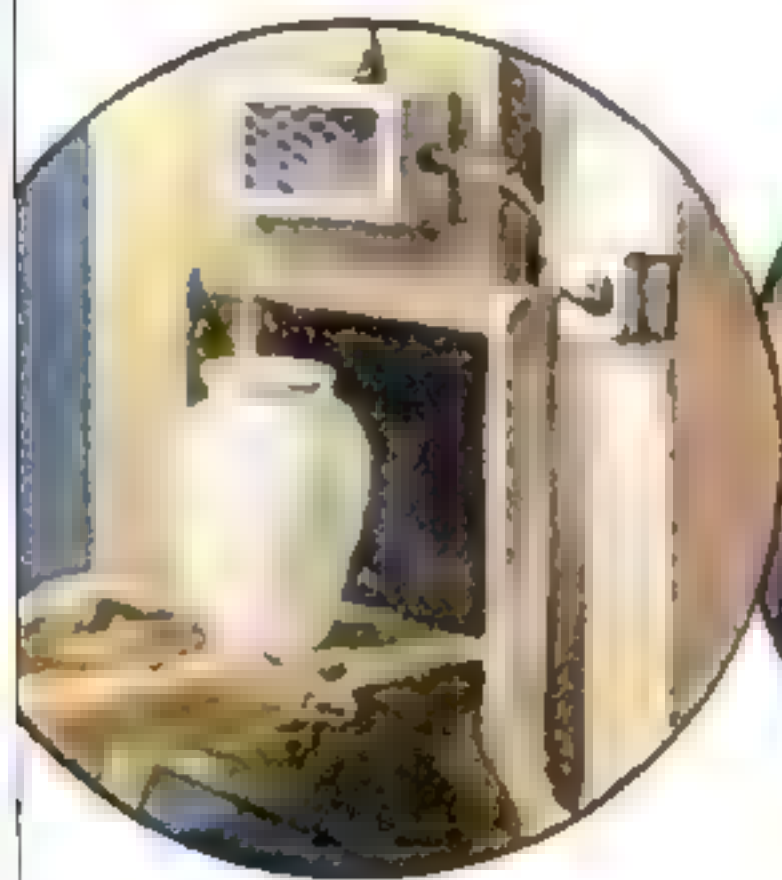


In a spray booth, a worker coats a sample piece of pottery with a new color solution for a trial firing in a high-temperature electric furnace



Every possible metallic pigment is tested in the never-ending search for new colors. One of the newest shades, a rich yellow, owes its beauty to vanadium. Up until a decade ago, vanadium was a costly metal—much too costly for use in tinting pottery. Then the steel industry began using it to increase the strength of automobile axles. When large quantities were ordered, large-scale production caused the price to drop, and the color wizards were quick to add it to their stores of available coloring materials.

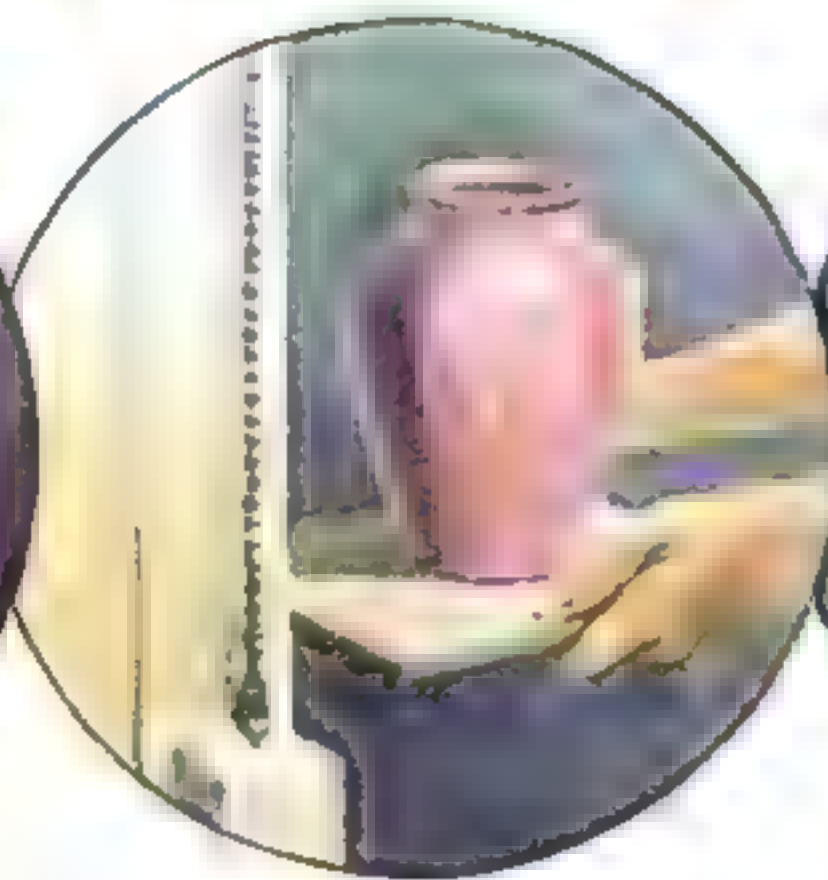
In the course of their research with various pigments, the Du Pont experts often succeed in duplicating a rare shade previously available only in priceless art objects and expensive copies. For the first



When it goes to an electric oven for first firing



After this, it is coated with the coloring material



... and exposed to white heat in this glazing oven



The result is a permanent coat of rich color



time in America, for example, the prized ox-blood color of ancient Chinese pottery has been matched and can now be duplicated economically.

When a manufacturer of china or glassware places an order with the laboratory for a specific pigment, he may make his choice from thousands of sample shades, or the chemists will undertake to match a color or duplicate the hue of a vase or dish from anywhere in the world with a custom-made tint.

Producing a desired shade sometimes takes months of careful experimenting. Time after time, the color chemists mix minerals together until they obtain just the right combination. As each trial compound is made, it is blended and fused in a superhot furnace, pulverized in a grinding mill, mixed with a liquid medium, and finally sprayed on samples of pottery and tile. Then the white heat of an electric furnace transforms it into a permanent and colorful coating. Often the heat entirely alters a hue, and the experimenters must begin all over again. When a trial batch of the desired color has been made successfully, the pigment goes into large-scale production.

The color expert's job does not end at the Perth Amboy plant, however. For even after the pigments have passed the laboratory

Left, a scene in an American chinaware factory, with racks of plates drying in molds. Below, sample tiles being placed in a furnace at the Du Pont laboratory



tests and have been shipped to the pottery manufacturer, technicians often follow them into the factory for special field tests.

One of the hardest research nuts cracked at the laboratory in recent years was stabilizing the various shades of vermillion. For years, troubles dogged the efforts of the research workers. They changed their formulas again and again. They tested sample after sample in their electric furnaces. Always, the least variation in conditions caused the color to turn black or to burn off. Finally, not so many months ago, they licked the problem and now you can buy vermillion pottery colored by a staple pigment.

In their work, America's color wizards are not only providing new beauty for your table china, your flower vases, and your gayly tinted bathroom and kitchen tiling, but they are writing a new chapter in the story of ceramics—a history that dates back to prehistoric times. For centuries, the art relics of ancient China, Persia, and the early European civilizations have been highly prized for their excellence of color. But today, their beauty is being challenged by the products of our own modern "rainbow" laboratories where chemical research is providing colors with tone and luster that were once unattainable.

Masked workers tend the mechanical sifter, right, and the rotary mixer, below, used in preparing the coloring materials. Lower right, an optical pyrometer in use





With the new color camera described on these pages, amateurs now can print their own color pictures, like the one above, in their own darkrooms. It takes both indoor exposures and outdoor action shots for either contact prints or enlargement.

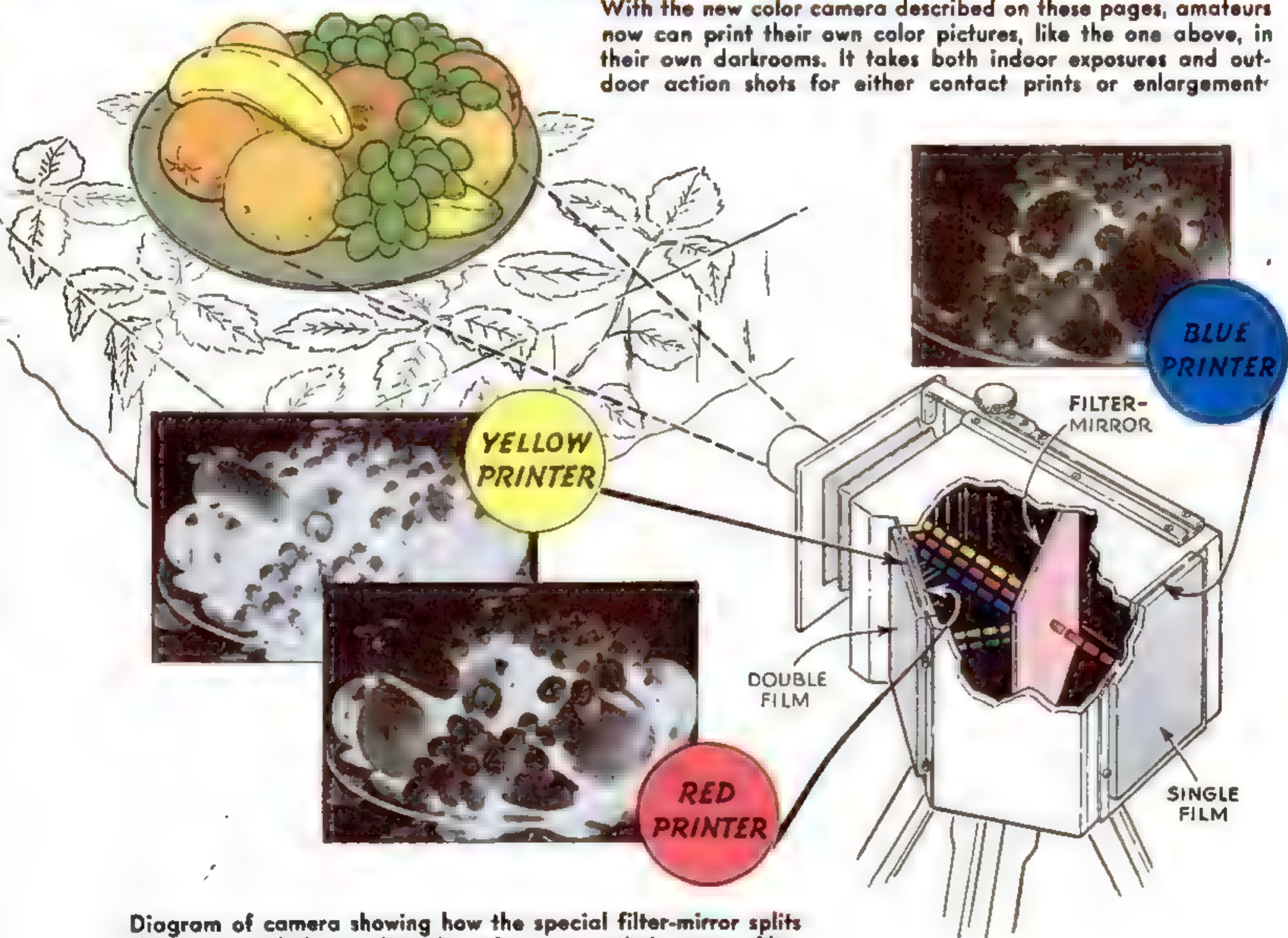


Diagram of camera showing how the special filter-mirror splits the incoming light, sending the color rays to their proper films

NEW CAMERA
GIVES

Inexpensive Color Prints



Three films in the camera seen in use at upper left are used in making the natural-color photoprints



Key of easy color-printing process is this device that reads density of the negatives

NO LARGER than many box cameras, an ingenious new "candid" color camera now enables the amateur photographer to make inexpensive natural-color photographic prints—in his own dark-room—from his snapshots.

Designed by Adrian Le Roy, New York City photographic chemist, the new camera is of the "one-shot, color-separation" type, meaning simply that each time you click its shutter, you expose simultaneously three separate films—one for each of the three primary colors, red, yellow, and blue. A "filter-mirror" that both transmits and reflects light, splits the incoming light beam from the lens in two, sending the proper color rays to the three films, as shown in the drawing on the opposite page.

Supplied with the camera is a separate unit called a densitometer, which is the key to a simplified developing process, worked out by

the inventor, that makes use of standard developing equipment found in most amateur dark-rooms. Producing its own "cold light," light almost devoid of the heat of its tiny electric bulb, this unit analyzes and compares the three developed negatives, and indicates its find-

ings on the dial of a conventional exposure meter. From this the amateur finds the proper exposure times for copying the negatives on special transparent films. Still using the readings to guide him, he immerses each film copy in its respective color dye. When the picture image on each of the three transparencies has absorbed its dye, each is then placed in turn in the same position or "register" on a piece of fixed, white printing paper, and then removed. Acting as printing plates, the three transparencies transfer their dyes to the paper to produce a print in natural colors. The camera is available in professional as well as amateur sizes.



A. M. Loungway, right, with his signal that shows how soon traffic lights will change

Signal Warns Light Beaters

INVENTED by Arthur M. Loungway of Endicott, N.Y., an improved traffic signal is designed to prevent motorists and pedestrians from being caught while trying to "beat the light" at intersections. Of sixteen light bulbs set into an aluminum ring attached to a conventional traffic signal, fifteen are white and one red. The bulbs light up consecutively to indicate the number of seconds remaining before the traffic light will change.

Bacteria Get Food in Capsules

CULTURES suitable for laboratory cultivation of bacteria and other microorganisms are now available to the amateur microscopist in convenient capsule form. Obtainable in packages of ten, twenty-five, or 100, the capsules are made ready for use by dissolving their contents in a measured amount of water, and then sterilizing the solution. A variety of cultures are available.



Contents of capsule dissolved in water makes germ culture

Houseboat Follows Tom Sawyer's Trail

INSPIRED by the imaginary adventures of Tom Sawyer and Huckleberry Finn, famous Mark Twain characters, Andrew W. Anderson, a clerk in the U.S. War Department offices, and his wife are drifting down the

Mississippi River to New Orleans, La., on the engineless houseboat shown in the photograph below. Long sweep oars provide the only means of maneuvering the odd craft along its winding course.



Andrew W. Anderson and his wife aboard the houseboat on which they are drifting down the Mississippi River

Legpower Helicopter Is Used In Tests

WILL anyone ever be able to fly under his own power? Most experts believe it can't be done, but the American scientists who built the curious apparatus pictured here aren't so sure. At least, they propose to find out just how human muscles rate as a potential power plant for aviation. Designed for testing rather than flying, this "legpower helicopter" employs an airplane-type propeller that is spun by foot pedals, while a gauge shows the pace attained. If the operator develops enough "lift," the bicycle-type seat and supporting shaft slide upward within the stationary outer framework. In one trial, it is reported, a subject raised the "pedal plane" six inches off the ground by pumping on the pedals.



With this odd earthbound flying machine, scientists tested the ability of a human being to rise from the ground under his own power. Below, measuring the "altitude" attained at end of test





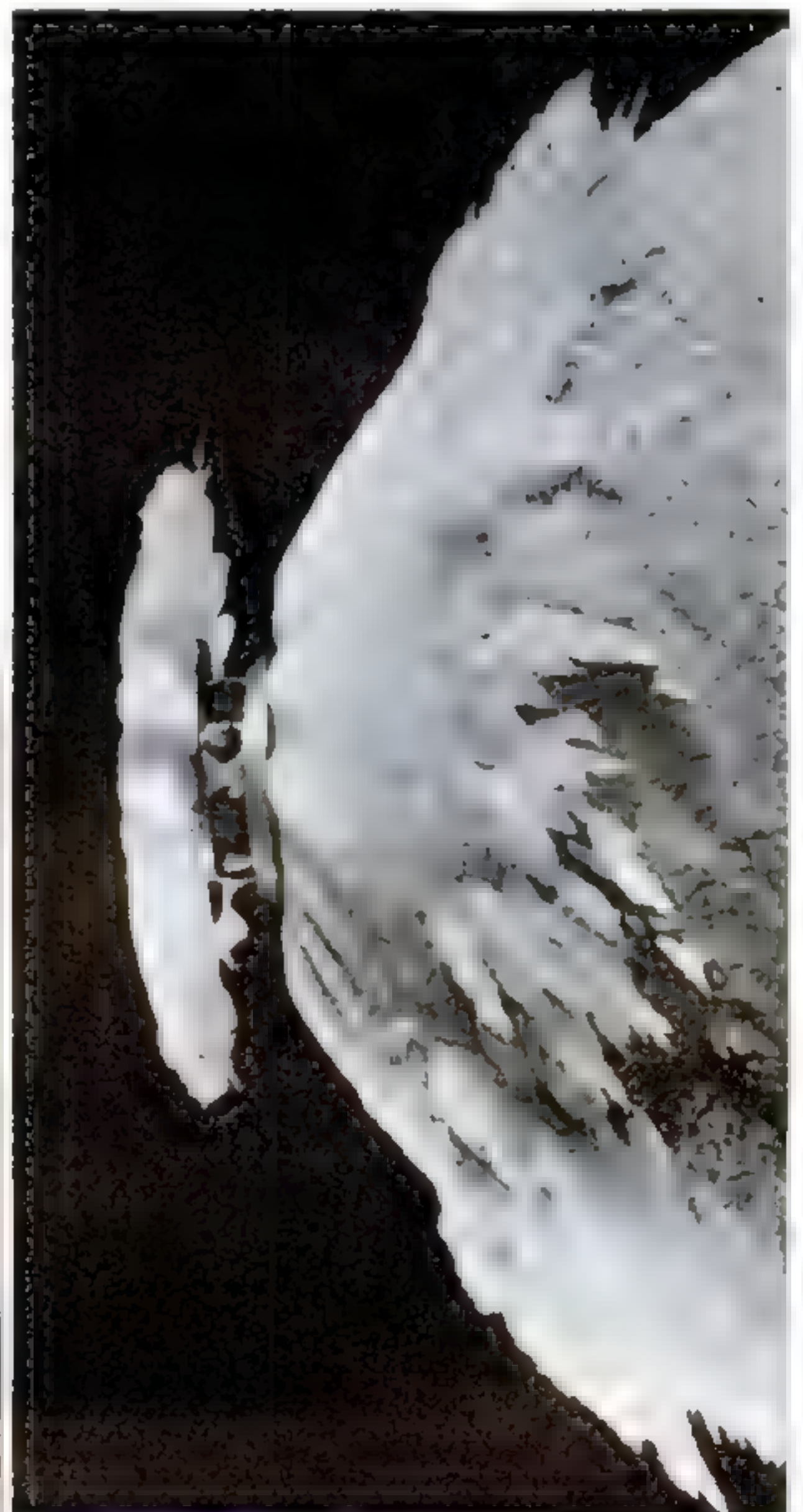
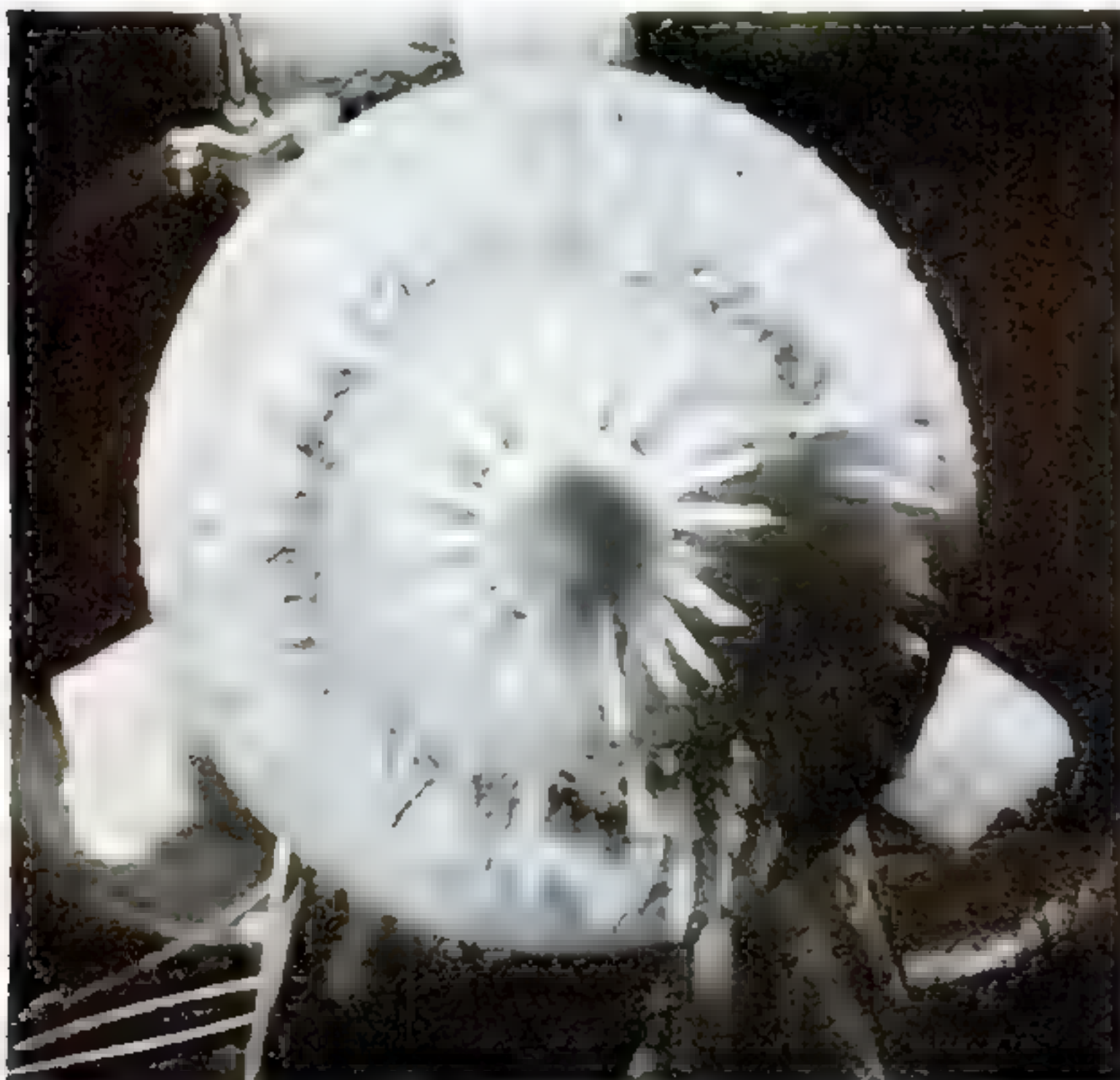
Duets Played on Giant Harmonica with 320 Notes

MORE than a yard long, a giant harmonica designed for playing duets was one of the outstanding features among the \$2,000,000 worth of musical instruments on display at a recent exhibition in Chicago, Ill. The mammoth mouth organ built for two, shown in the photograph reproduced at the left being played by two visitors to the exhibition, measures forty-one inches from end to end, and has a range of 320 notes, extending all the way from deep bass to high treble.

Forty-one inches long, this oversize harmonica has a range of 320 notes

Planes Blossom with Ice in Wind-Tunnel Tests

TO DETERMINE the best methods of preventing the accumulation of ice on airplanes in flight, Goodrich engineers have been conducting an extensive series of tests in a special refrigerated wind tunnel at their Akron, Ohio, laboratory. One of the many strange and beautiful ice formations resulting from their experiments is pictured in the photographs below and at the right.



Strange ice patterns formed on the nose of a plane in de-icing tests with an eighty-mile gale at eight degrees below zero

Golf Course Becomes Desert for Movie



Imported sand, potted palm trees, and painted mountains helped create this desert scene for "Suez"

THREE THOUSAND truck loads of sand, scattered over the greens and fairways, transformed a golf course near Hollywood, Calif., into a twenty-acre desert for the filming of a spectacular storm scene during the production of the motion picture "Suez." Nine different kinds of sand found along the shores of southern California were tested photographically before cameramen finally selected one type which matched that found near Yuma, Ariz., where other scenes in the picture were taken. Artificial palm trees planted by studio carpenters in boxes sunk into the ground, and a realistic background of painted hills, completed the man-made desert. For the storm sequence, a battery of powerful wind ma-

chines, consisting of twelve propeller-type blowers driven by airplane engines, whipped up gales that reached a velocity of sixty miles an hour on certain parts of the set.



During a synthetic sand storm, dummy water towers were tipped over with jacks



The artist signs his name to his portrait of Jessica Dragonette, radio singer, done in cosmetics. The inset shows the materials

Artist Paints Face with Face Paints

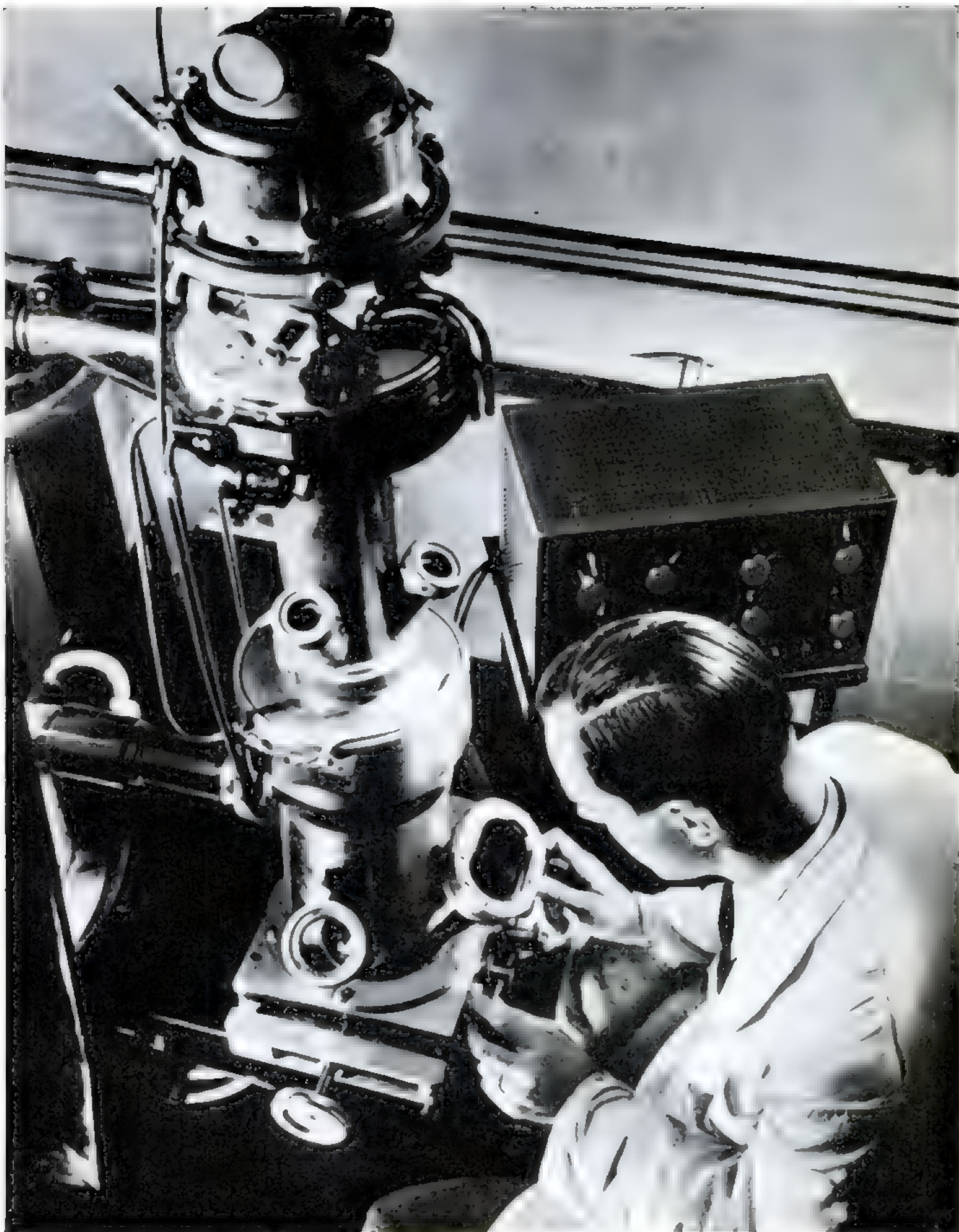
ROUGE, lipstick, face powder, mascara, eye shadow, and other cosmetics formed the materials used to paint the portrait of Jessica Dragonette, radio singer, pictured in the photographs above and at the left. Completed by the artist in less than thirty minutes, the novel cosmetic portrait employs artist's colors only for the hair and the flowers on the hat.

Mechanical Pitcher Exercises Batsmen

A BASEBALL pitching machine whose "arm" will never tire, no matter how long it labors on the mound, is a recent invention of Byron Moser, of St. Louis, Mo. Operating in much the same manner as mechanical apparatus that hurls tennis balls for practice stroking, the automatic pitcher serves a perfectly placed ball at each pitch. Electrically driven, the unit throws at the rate of one ball every fifteen seconds. Both the speed of the ball and its height can be regulated at will by adjusting controls on the machine. A metal shield prevents the mechanical moundsman from being damaged by batted balls driven back against it.



Byron Moser swinging at a fast ball thrown by his mechanical pitcher



Supermicroscope Magnifies 100,000 Times

EMPLYING a stream of electrons, tiny electrified particles, instead of a conventional glass lens, the gigantic supermicroscope pictured above can magnify minute objects as much as 100,000 times—a magnification comparable to enlarging the head of a

pin to a diameter of 330 feet. Designed by Dr. B. von Borries and Dr. Ernest Ruska of Berlin, the German giant electric "lens" is adjusted and regulated by means of a control panel resembling a radio switchboard. It is expected to aid in fighting disease.



Floating Mower Cuts Weeds in River

WEEDS and tangled grasses that often clog streams, rivers, and lakes, making them difficult to navigate, are eliminated by the odd floating mowing machine shown in the photograph above. Perfected after seven years of work on the part of George Sanger, of Rockwood, Mich., the curious craft is pow-

ered by a gasoline motor that drives a pair of paddle wheels mounted on the sides. A mowing unit, projecting out in front of the weed-cutting boat, is lowered into the water. As the craft moves along, oscillating blades powered by the gasoline motor slice off the marine growth below the surface of the water.



New Gas Mask Covers Baby Completely

BABIES are protected from poison gas in case of a wartime attack by a novel mask recently invented in France. An air-tight sack, within which a baby is placed, is fitted with a transparent window, and equipped with a rubber lung and a filter unit to remove impurities from the air. The person holding the infant controls the amount of fresh air entering the shelter by pressing on the rubber-lung unit.

Labels Made for Typing

TRANSPARENT paper next to the adhesive on gummed labels now available in strips, makes it possible to place the labels in a typewriter for marking without having them stick to the roller. The backing then is stripped off and the labels stuck in place.



A doll demonstrates the use of the baby gas mask. Filtered air is pumped in with an artificial lung

Police Car Is Traffic Court on Wheels

Motor-cycle policemen arrest traffic violators and bring them to a parked car

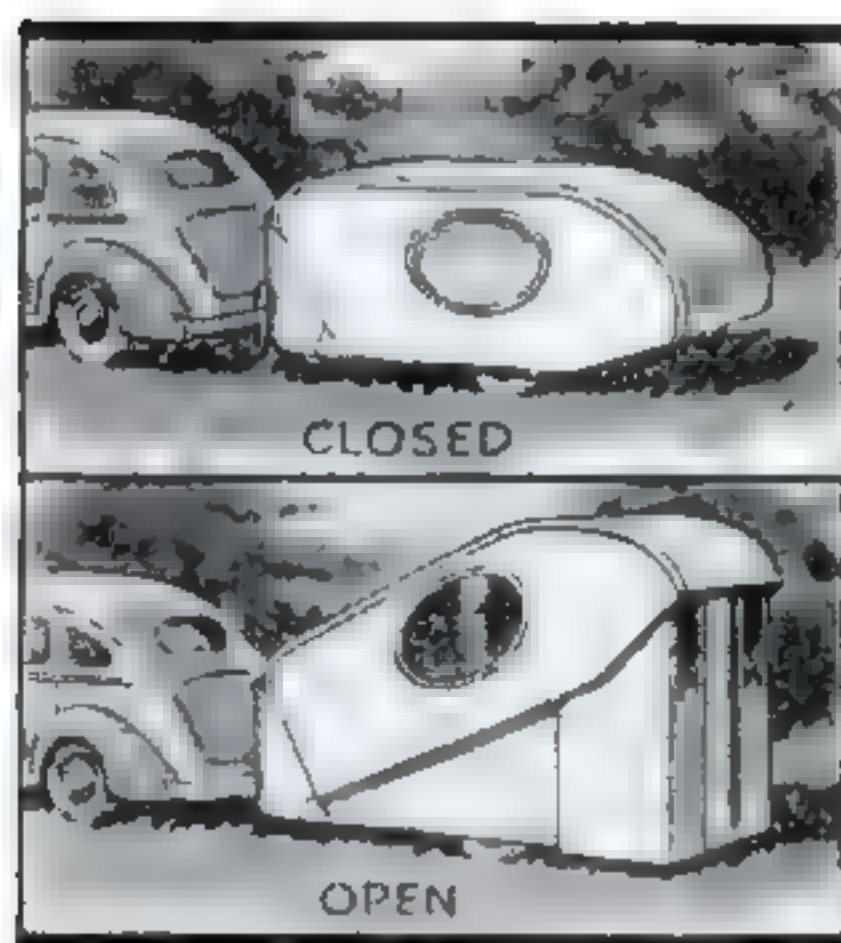
Summons and records of offenses are made out at once on a typewriter



A POLICE station on wheels is now serving as a mobile traffic court at selected highway intersections in Cleveland, Ohio. Speeders, drivers who ignore traffic lights, and other traffic violators are spotted from the parked police automobile, arrested by

motor-cycle police assigned to the mobile unit, brought to the car window for booking, given a summons, and bonded for later appearance in regular traffic court. Summons and records of offenses are made by an officer within the car on a typewriter hinged to the back of the front seat. The system of traveling police courts, which can move about to locations where traffic is heavy, is expected to speed up the handling of traffic cases by performing some of the court's procedure right at the scene of the violation.

Telescoping Trailer Makes Cozy Overnight Cabin



How the trailer appears when closed and open. The drawing at right shows the pivoted rear wall folding back as the unit is closed



DESIGNED for tourists and campers, a compact collapsible trailer recently invented by LeRoy Smelker, of Dayton, Ohio, opens and closes as easily as a folding bed. Providing sufficient space for two built-in beds, the folding overnight cabin is opened out for use merely by lifting its back end, which raises the rear wall. Two windows flank the door, and two others are built into the telescoping side walls.

Fighting the DOPE

One of the men, a hulking
strongshoreman, leaped at me
with a huge butcher knife"



By
**HAROLD ("FLASH")
MURRAY**

Former U. S. Anti-Narcotic Agent

A DOOR creaked behind me. I swung around on the dark, evil-smelling stairway. Two "torpedoes," swarthy gunmen of a dope ring, blocked the stairs behind me. Another door opened above. Three more torpedoes, guns in hand, stepped out ahead of me.

For weeks, I had been on the trail of an elusive narcotic king known as Tally-Ho. An anonymous tip had brought me to a squalid East Side tenement house in New York City. After seven years in the narcotic service, after sending more than 500 men to the penitentiary, I was in a trap of the underworld.

One of the men picked up an empty ash can. I knew what that meant. By send-

Not satisfied with the thousands of addicts on whom they already have a hold, the vicious dope rings also prey on the innocent. These photographs, posed by the author, show how a "steerer" finds a new customer for his wicked trade. Every possible trick is used to entice a new victim into trying some form of narcotic

Curiosity leads many to take the fatal step. The steerer guides his victim to an opium den, making sure they are not followed



RINGS



ing it clattering down the stairs, he would cover the sound of gunfire. Before he could drop it, however, there were footsteps on the stairs. A woman and her three children were coming down from the top floor. The torpedoes whipped their guns into their pockets. They put on an act, pretending we were all pals. In a flash, I made up my mind. If I was to be murdered, it would be before witnesses. So, when the woman passed, I stepped out and walked down beside her. Any second, I expected to feel lead in my back. But the torpedoes, taken off guard, didn't know what to do. Once in the street, I vanished like a rabbit.

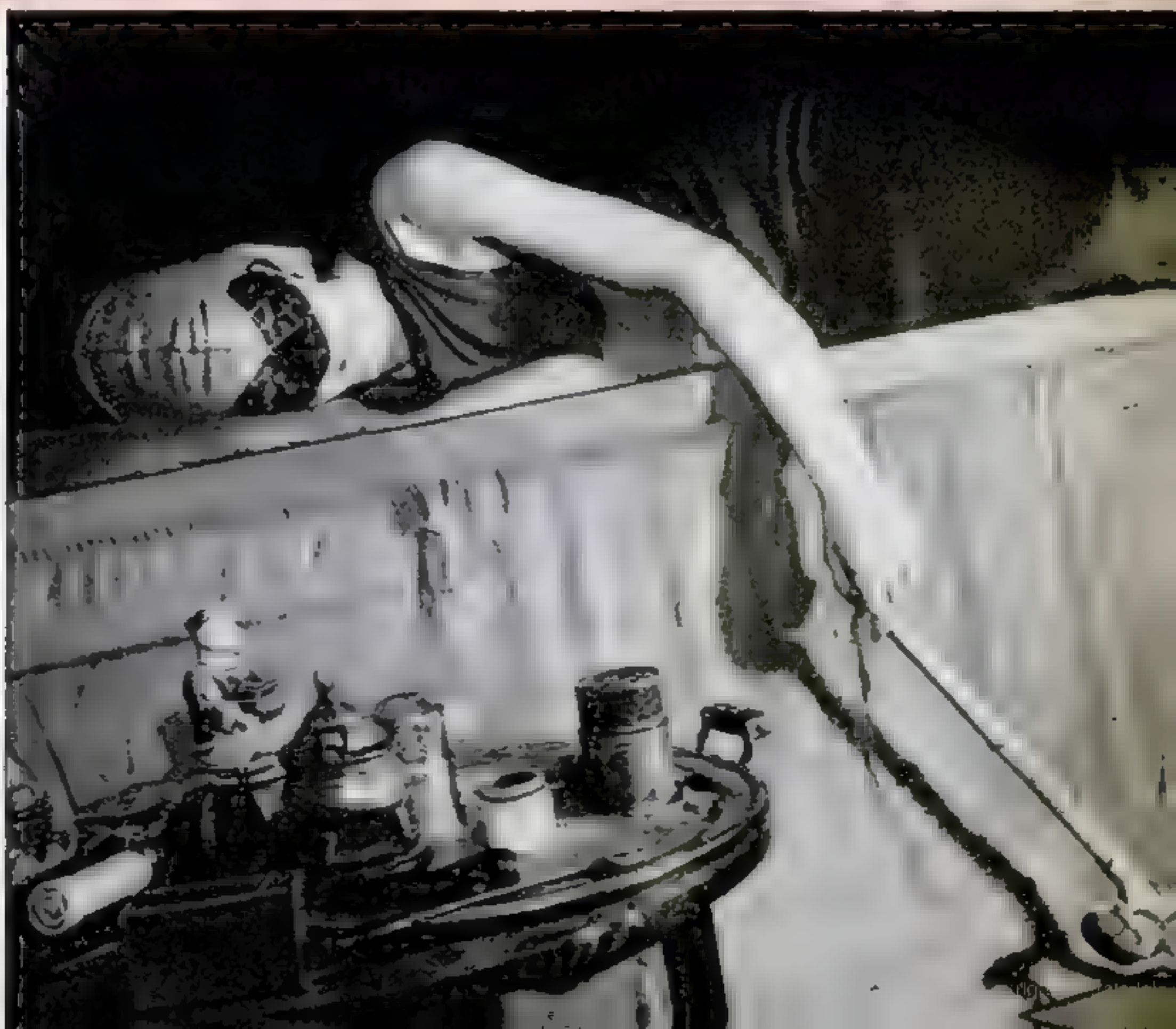
But I came back a week later, walking on crutches. That is a favorite ruse for getting in close before a raid. Because nobody pays much attention to a cripple, I wound bandages around one foot and hobbled down the street toward the tenement. Opposite the door, I hurled the crutches in the gutter and tore into the building. Other Federal men, planted on all sides, followed me. We hit the gang's hideout like terriers in a rat's nest. Outnumbered, the same men who would have killed me without batting an eye when they had me alone, surrendered without even reaching for a gun.

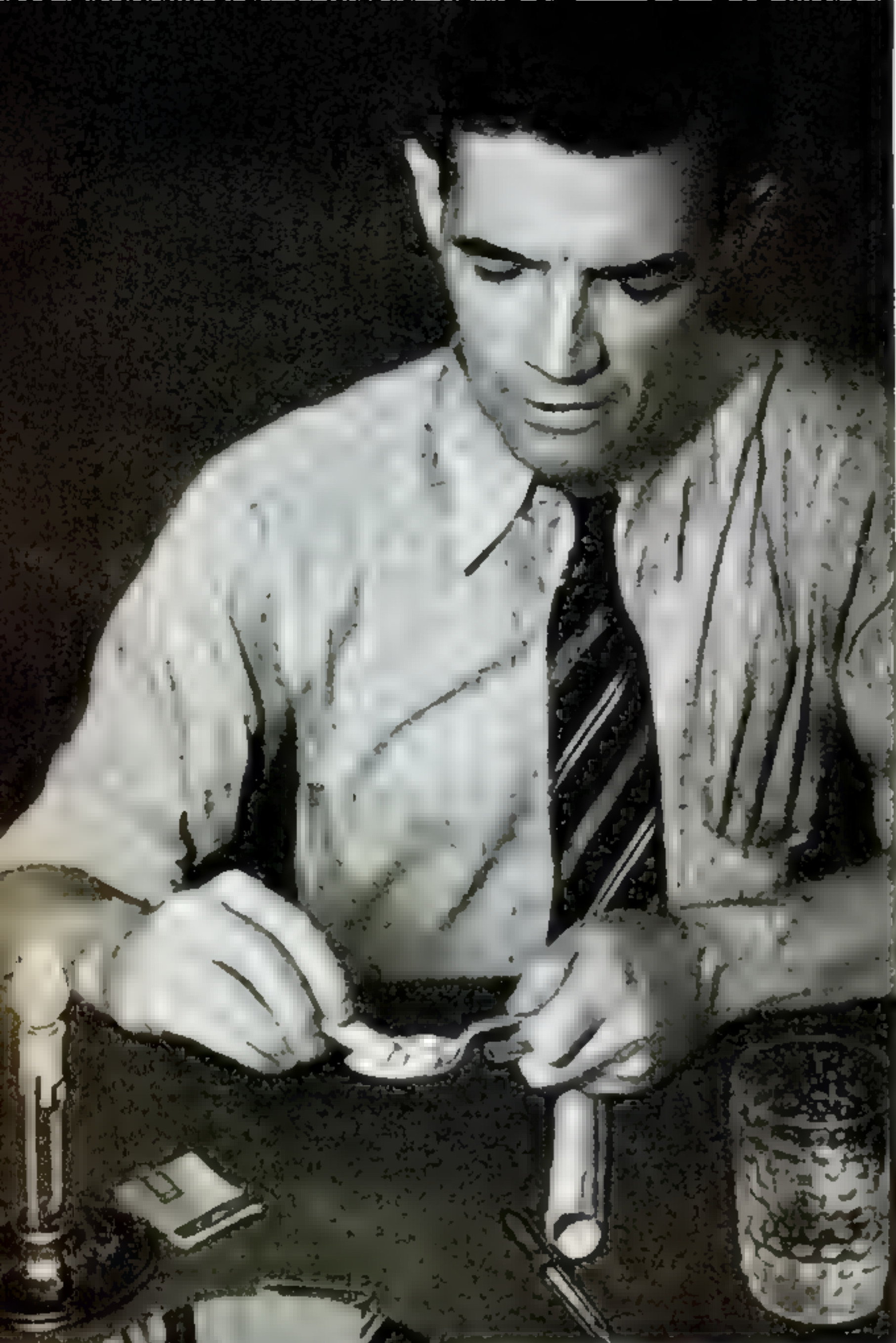
Trailing organized dope gangs is one of the toughest and



now hopelessly in the grip of the dope habit, the addict craves more and more of the drug. Here her pipe is being loaded with a pill of opium cooked over a peanut-oil lamp

After smoking twenty or thirty pills, the victim drops off into a deep sleep, which is often a hellish nightmare. Many times, death is the only release from the habit. To disguise the telltale fumes of the opium, incense is burned or dampened sheets are hung over doors, as shown above





Holding the spoon over a match flame, he dissolves the drug in a few drops of water. The warm liquid is then drawn up into the medicine dropper, as seen in the photo at right

Here the author shows how a victim will even risk infection to continue his habit. Taking a small amount of heroin from a hiding place—in this case a lamp—he places it in the bowl of a spoon



Dope fiends will go to any length to satisfy their uncontrollable craving. A medicine dropper, spoon, and safety pin are a "poor man's hypodermic" for using deadly heroin

most dangerous forms of crime-fighting. You are dealing with human rats, cunning and ruthless. The pay is never big. But there is tremendous satisfaction in outwitting these enemies of society.

I got into it after the war. As a boy, I grew up in the toughest part of the South Side in Chicago. Many of my boyhood friends later became gangsters and ended in prison—or the morgue. I was lucky enough to keep out of trouble and end up on the right side. When I joined the narcotic service, I was put out on my own. It was sink or swim. The first time I reached a dope peddler, he spotted me in an instant. I asked for "two dollars worth of morphine." If I had been a real addict, I would have said "a bindle of junk" or "two decks of M." Knowing the lingo of the dope world, a lingo that is continually changing, is an important part of the equipment of a Federal agent.

Learning the infinite variety of ruses and dodges used by dope sellers and addicts is equally important. Almost every case on which I have worked has taught me something new about the wiles of the underworld.

In Newark, N. J., we once raided an opium joint on an upper floor. Stairs that led to it were so steep that a man would lose his balance if he tried to swing an ax to smash in the door. A second agent had to stand on the step below and brace the man with the ax. When we finally broke in, we searched for hours before we

found the incriminating pipes and drugs. Looking for a false bottom in a bin, we shoveled out two and a half tons of coal. Then, we discovered that while we were smashing in the door, the inmates of the dive had been pushing the pipes and opium out under our feet, into a hollow doorsill!

An old maneuver which permits a gang to shift a "plant," or store of drugs, to a new location in a few seconds is what is known as "hanging out the wash." Across an areaway between tenement buildings, an endless clothesline is stretched. Socks are hung just outside the window of the room where the dope is stored. At the first sign of trouble, the drugs are dumped in the socks and pulled across to a window in the other building. Here, a gang member quickly removes the plant to a place of safety.

On the lower East Side of New York City, I first encountered the "two peas in a pod" ruse. A man dressed in a checkered cap, a blue shirt, and brown trousers took five dollars from a Federal agent who was posing as a dope addict and left to get the drugs. Five minutes later, the checkered cap, blue shirt, and brown trousers appeared again. I stepped across and made my arrest. Then I discovered that I had a different man, dressed exactly like the first one. As we needed both the marked money and the drugs to make a holeproof case, the trick had cheated us of half our evidence.

Switching cars is another frequent practice of dope mobs. They will take a buyer in one car, receive his money, and then signal a second machine. As it speeds past, they toss the money into it and the dope is thrown back into their car. Then, if the purchaser is a Federal agent, he is able to hold the occupants

of only one car and will have only half the evidence he desires.

Probably the slickest dealer in narcotics I ever encountered was one operating in Detroit. He was a former internal-revenue man who had gone bad. I was sent out there to collect evidence on the notorious Purple gang and soon ran across his trail. He had what seemed like a holeproof set-up. Nobody ever saw him. Buyers put their money in an empty cigarette package and tossed it in a window on the ground floor of a respectable-looking house. Then they walked one block beyond, turned around, and walked back. As they passed the window, the drugs were tossed out to them. All operations inside the room took place behind a curtain and the doors were reinforced and barricaded. I made the arrest by diving through the window in a surprise pounce that



Blood poisoning has no terrors for the dope-crazed mind. Jobbing the safety pin into his arm, the addict forces the point of the medicine dropper, into the puncture and then squeezes the bulb



caught the criminal with all the needed evidence on him.

Another ingenious scheme was one I encountered in Chicago. The dope peddler would leave his drugs in public lockers at elevated-railway stations. Then, when the addict had paid him the money, he would hand him the key to the locker. In this way, he was never near the site when the narcotics were obtained.

In tracking down these crooks, I used a wide variety of disguises. Sometimes I played the part of a "dodo," a bum in the street seeking a cheap shot of dope. Again, I would pretend to be a "wing-dinger," an addict who specializes in stealing physician's prescription blanks and using forged prescriptions to get narcotics. The easiest role was that of a "beef-steaker," a beginner who is not yet a confirmed addict. In some cities, I would let it get around that I was a pickpocket. To gain the confidence of gang members, I would steal my own wallet which had been planted in the pocket of another Federal man!

I always kept on buying until I had got to the higher-ups who supplied the "pushers," or peddlers with their vicious wares. Usually, I would be shadowed by another Federal man, a former ace intelligence officer. He, in turn, would be trailed by a husky 200-pounder ready for battle. If I got in a jam, I broke a window as a signal and these helpers rushed to my aid.

Finding the narcotics, after we had raided a hangout, was sometimes as difficult as trailing the dope mob to its lair. There are literally thousands of unexpected places where you find the drugs secreted. I have discovered them in fountain pens, lamps, hat bands, rub-

ber heels, fish, hollowed-out handles of tools, and in a host of other places. Once, I started to move a match box on a fireplace mantel. It wouldn't move. It was fastened tight and formed the door of a secret cache.

A few years ago, a gang running dope across the Canadian border used a grisly ruse to smuggle large quantities of heroin, morphine, and cocaine into the country. Dressed as a widow in deep mourning, a woman accompanied the body of her "husband" back to the United States. Three times in one year, the same widow made the same trip. An alert conductor became suspicious and tipped off the authorities. Investigation proved that the woman was a gang member and that an underworld undertaker had supplied the bodies which were filled with stores of various narcotics before being placed in the coffins.

All human sentiments and all sense of right and wrong seem lost to the dope addict. I have known brothers to give drugs to their sisters, and mothers to administer it to their children. I even encountered a case in which a woman had made an addict out of her pet white poodle.

Another pet, a black-and-white cat, led us to a big drug cache in one of the most thrilling raids I ever made. At the time, I had twenty-one stool pigeons reporting on the activities of the underworld. These informers used to meet me near the Aquarium in Battery Park, on the edge of New York Bay. We called them the "twenty-one seals." They noticed that a large number of dope fiends were riding the ferries to Brooklyn. These addicts left with a haggard expression and returned stepping high. Somewhere across the bay, they were obtaining their dope.

I trailed them to a certain block near the waterfront and made contact with the peddler. He would take your money and send you around the block one way while he went the other. Thus, you could not see which house he entered to obtain the junk. Once, by sprinting at top speed, I got around in time to discover him disappearing in a doorway. With the plant located, I was ready for the raid two nights later.

The building proved to be a sailors' rooming (Continued on page 246)

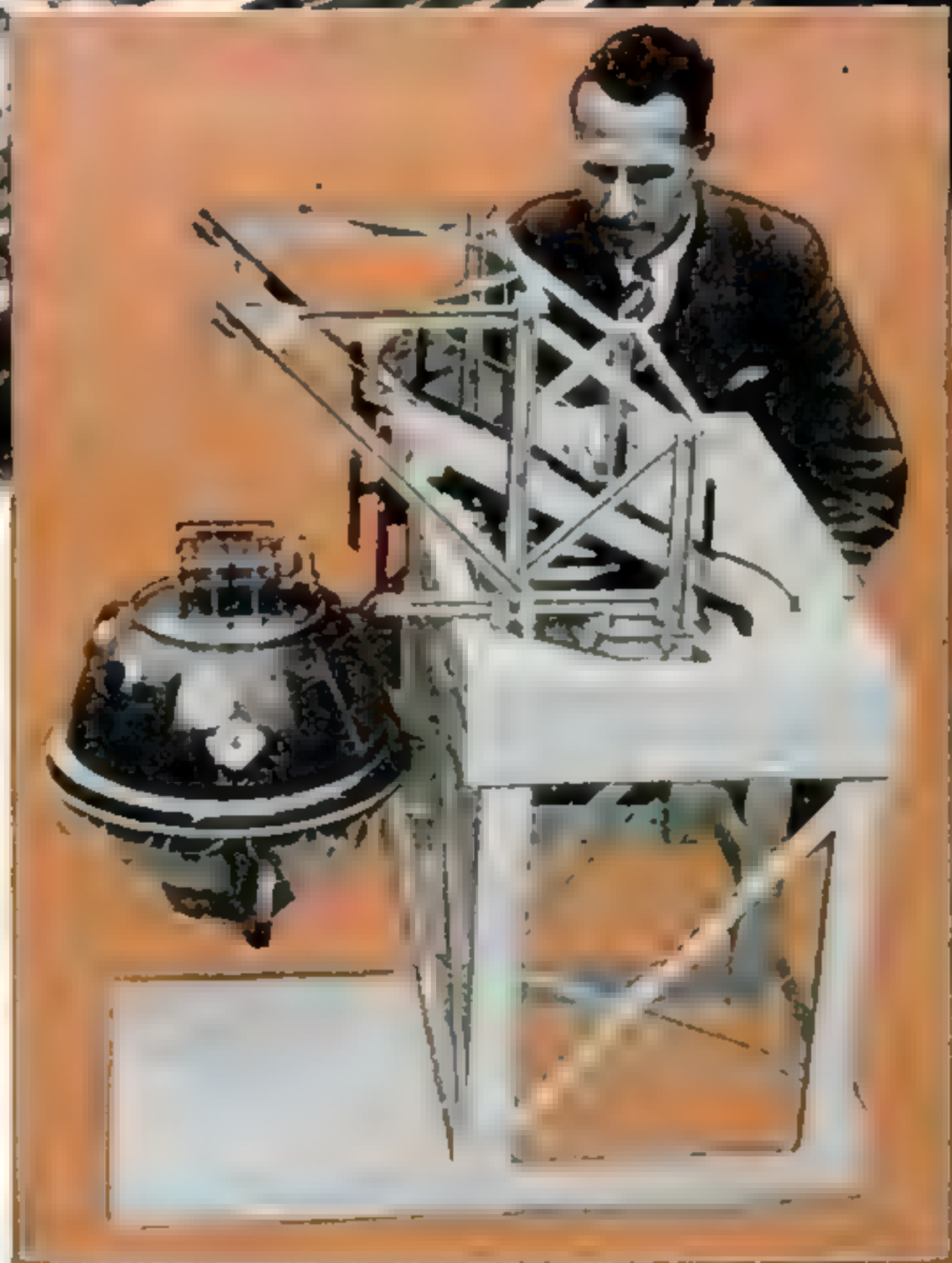


Uncle Sam's newest drug menace—marijuana. Here police officers are destroying a patch of the outlawed narcotic weed found growing in a vacant lot



Novel Life-Saving Ball Holds Ship's Crew

TOSSING and rolling in heavy seas, a new life-saving sphere for ocean-going ships, invented by Ronald T. G. Mason, English engineer, has an inner passenger-carrying globe mounted on twin pivots that allow it to remain upright regardless of the movement of the outer shell. Fitted with a radio, electric lights, emergency food supplies, and a water-tight ventilating system, a life-saving ball only twelve feet in diameter could safely accommodate the entire crew of a small cargo steamer, it is claimed. On shipboard, the sphere would be suspended from a steel launching rig reached from deck level by a sloping ramp.



Ronald T. G. Mason, British inventor, with a model of his sea-rescue sphere and its launching rigging

Tiny Homemade Racing Plane Cruises At 170-Mile Speed

Vincent Linberg, National Guard flyer, at the controls of the midget plane that he designed and built

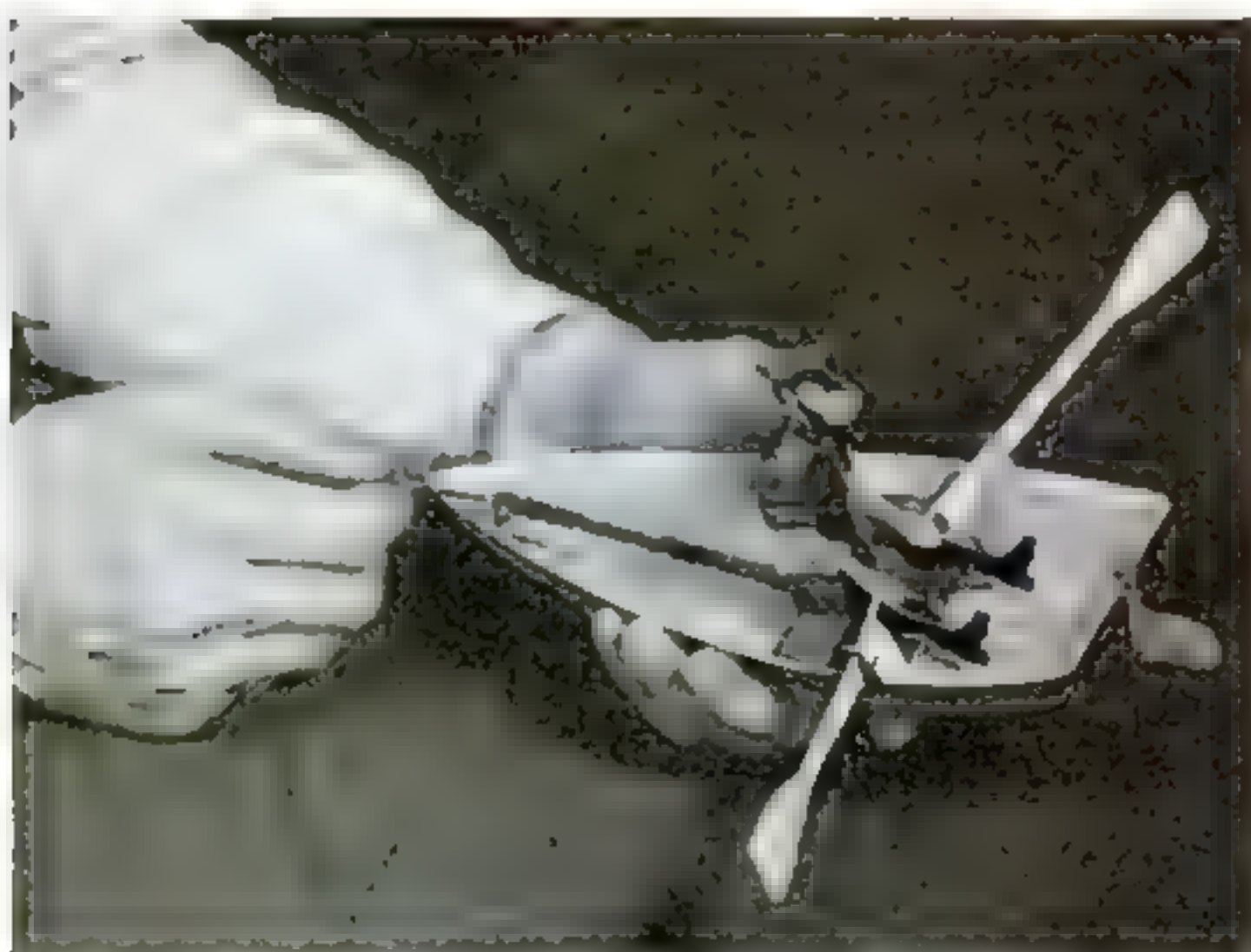


ON ITS first flight, a homemade midget plane built by Vincent Linberg, Missouri National Guard sergeant, recently attained a speed of 170 miles an hour. The tiny biplane measures only twelve feet from propeller to tail, and has a wing spread of

only thirteen feet. Powered by a standard 125-horsepower motor, the flying midget is expected to reach a top speed of 220 miles an hour when preliminary flight tests are completed. Linberg is pictured above about to take off in his diminutive ship.

Toy Sailor Pulls on Oars To Drive Model Rowboat

IN A novel toy boat now on the market, a metal model of a picturesque old sailor moves back and forth to row the craft across the surface of the water. Measuring eleven inches in overall length, the ingenious toy, shown in the illustration below, has a replaceable rubber-band motor to operate its rowing mechanism. A small adjustable rudder mounted on the stern steers the toy boat.



A tiny figure strokes the oars to propel this boat



Canned Fire Extinguisher

FIRE-EXTINGUISHING fluid sealed inside an air-tight can eliminates evaporation and the necessity of periodic servicing and refilling, in a new type of extinguisher for hand use. When a fire breaks out, a special hand pump fitted with a sharp projection punctures the can and sprays the contents to smother the blaze. The handy extinguishing device is shown in use in the photograph above.

Cornfield Is Laboratory for Breeding Tests

TO OBTAIN hardier plants and a higher yield, agricultural scientists under the lead of Dr. Wilson M. Compton have been employing a giant Virginia cornfield as an outdoor laboratory for cross-breeding experiments. A "pure" line of one type of corn is obtained by inbreeding it by self-fertilization for several generations. Pure corn lines are then crossed to obtain hybrid types, some of which are exceptionally high yielders, have strong, stiff stalks that withstand gales and torrential rains, and resist disease and drought.

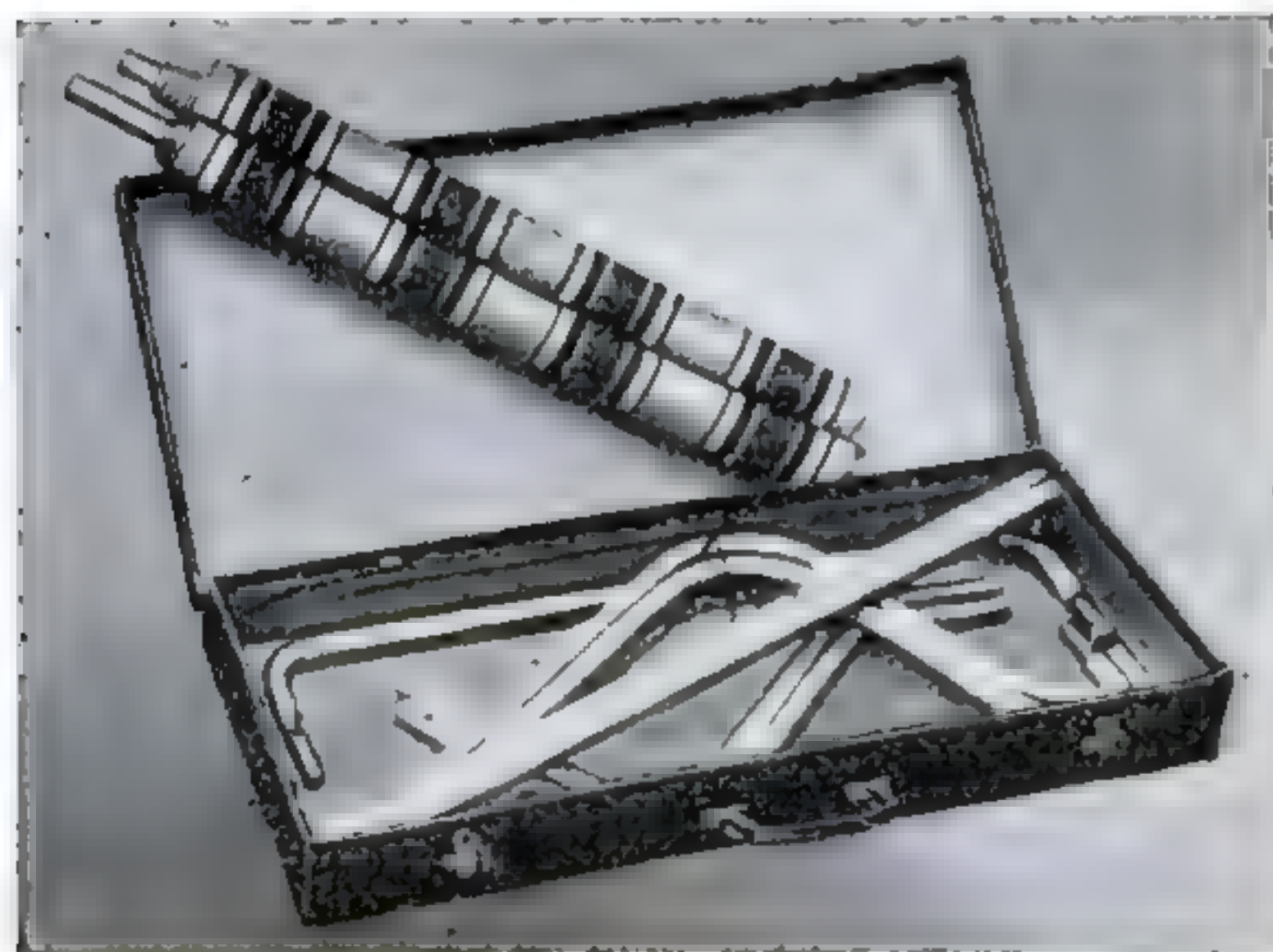


A female corn flower being covered for inbreeding

Mechanical Sewer Cleaner

CLEANING the 560 miles of storm sewers in Manhattan Island, New York City, may soon be done by machine, it was predicted after recent tests of a new type of sewer-cleaning equipment. The apparatus consists of a truck carrying drums from which cables are stretched through sections of sewer between manholes several hundreds of feet apart. The cables drag buckets which collect the sludge.

Portable Lounging Chair Fits in Carrying Case



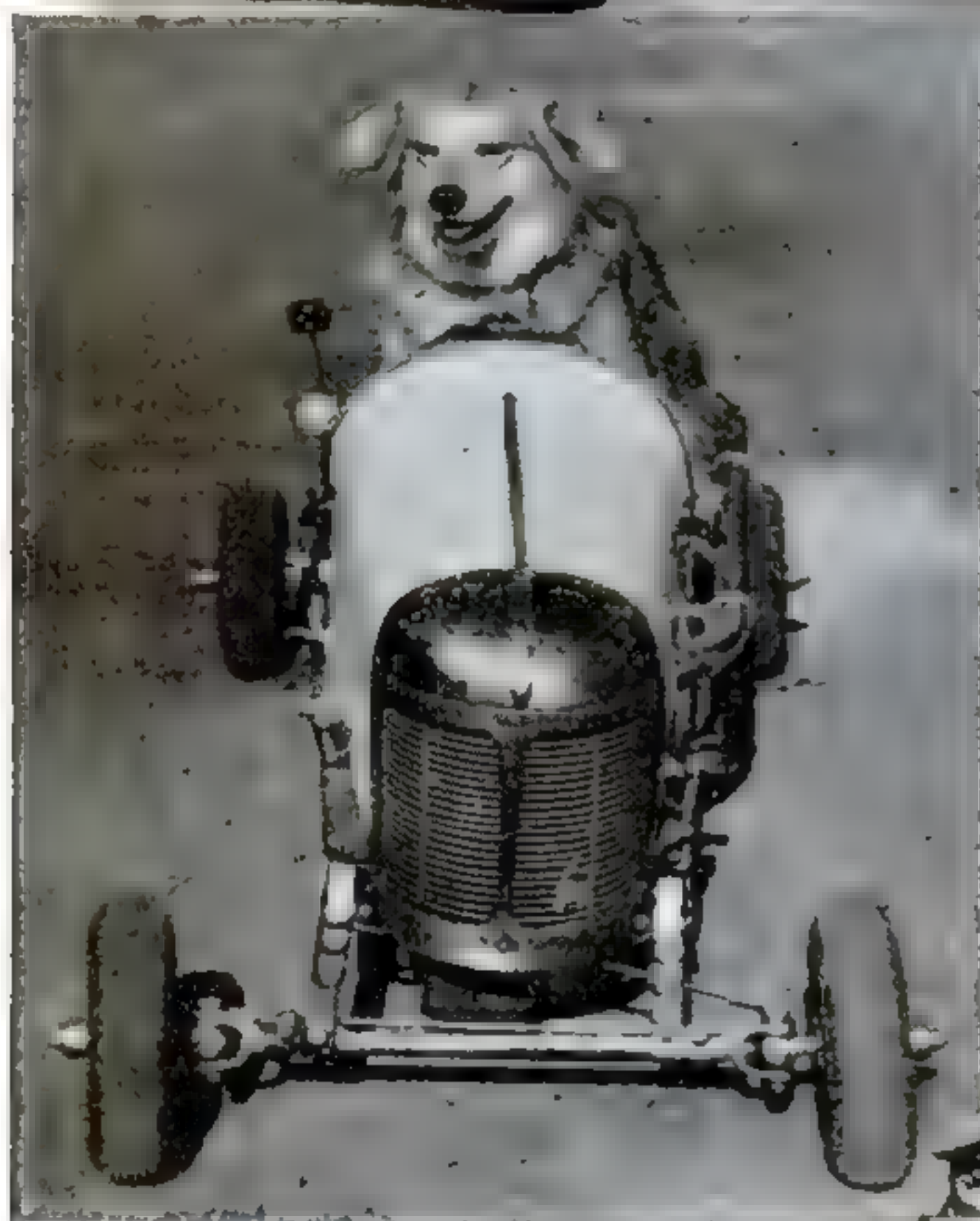
ENAMELED steel tubing forms the framework of a portable canvas lounging chair which can be dismantled and packed away in a light carrying case. As long as an ordinary cot, the sturdy chair is fitted with an adjustable sunshade at one end. The outfit comes apart as shown at the left.



New collapsible lounge chair in use. The sturdy frame of steel tubing comes apart so that the whole outfit can be packed for carrying in a case as illustrated at upper left

This car was built to be driven by a "ghost" in a movie. Duplicate controls on the floor were operated by a concealed driver

TAILOR-MADE

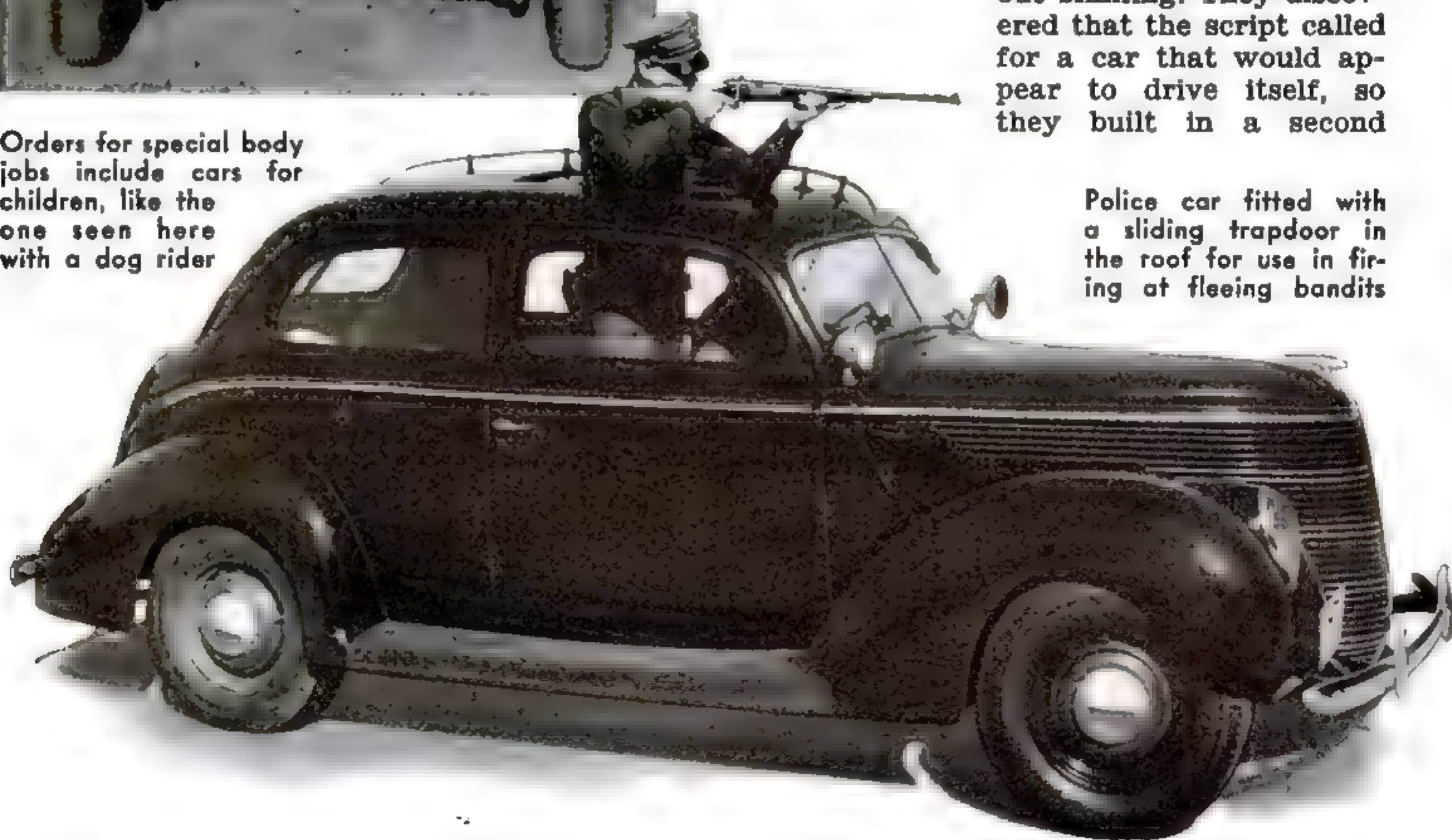


Orders for special body jobs include cars for children, like the one seen here with a dog rider

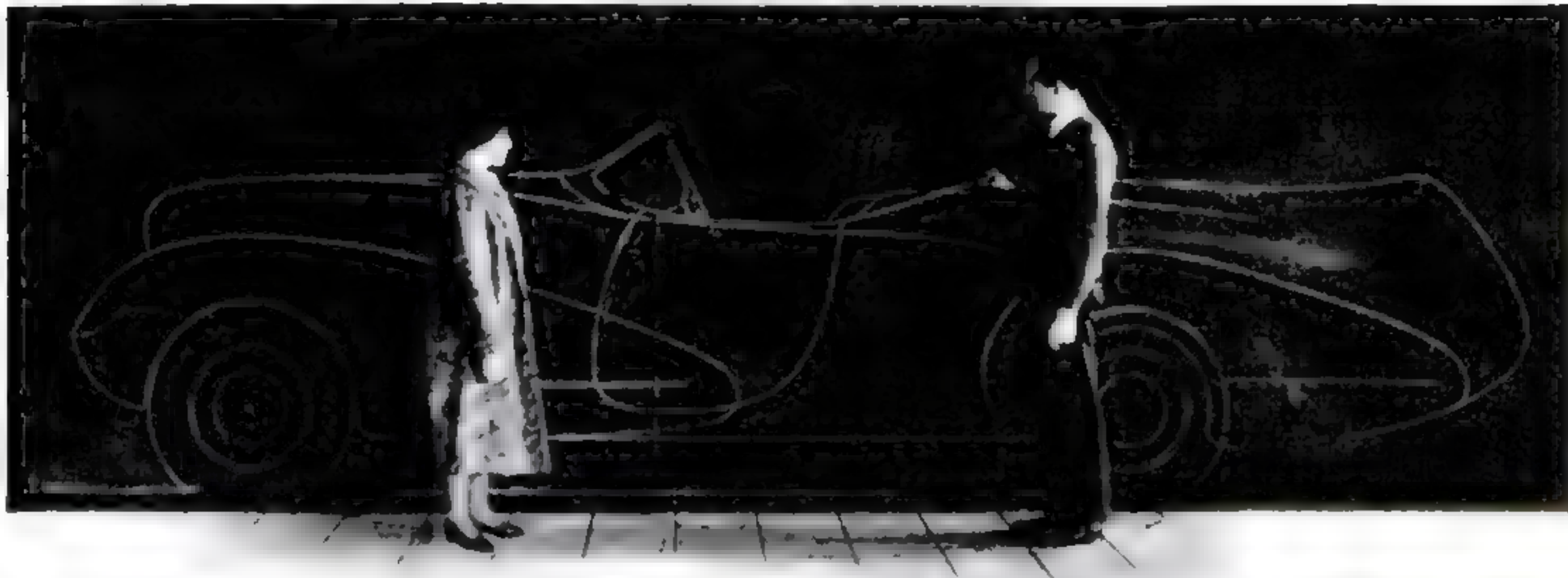
DESIGNING and building odd made-to-measure automobiles with such features as built-in water-supply tanks, photographic darkrooms, iridescent paint finishes, snakeskin upholstery, and other novelties is the unusual business conducted by Bohman and Schwartz, Pasadena, Calif., automobile-body builders. In their shop, the standard car-body job is more unusual than the unconventional.

Not long ago, for example, a Hollywood studio called for a long, low, rakish roadster, streamline from bumper to bumper, for use in a movie. After the job was started, a studio executive casually announced that provision must be made in the car for a "ghost." Bohman and Schwartz took this queer announcement without blinking. They discovered that the script called for a car that would appear to drive itself, so they built in a second

Police car fitted with a sliding trapdoor in the roof for use in firing at fleeing bandits



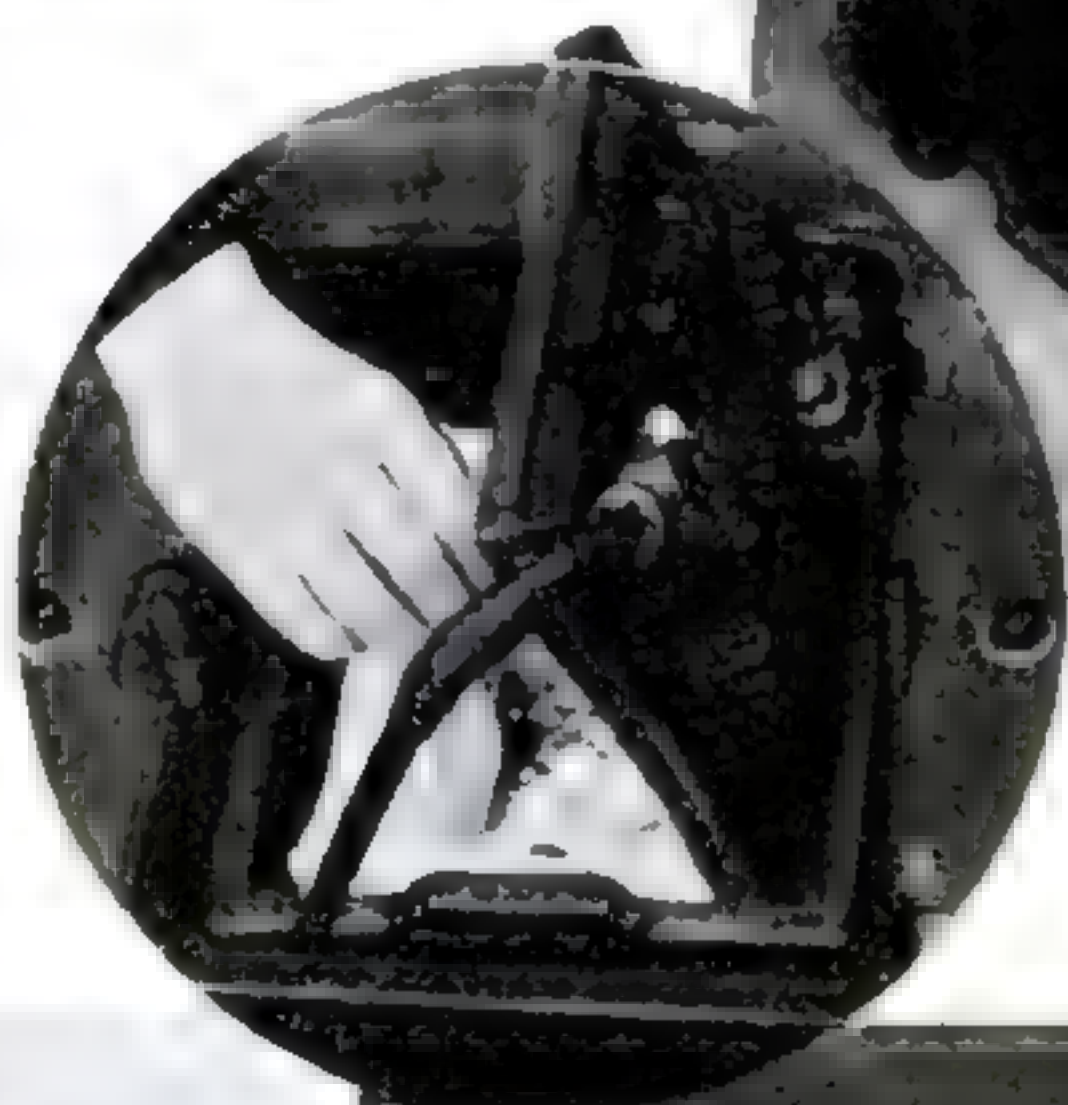
AUTOMOBILES



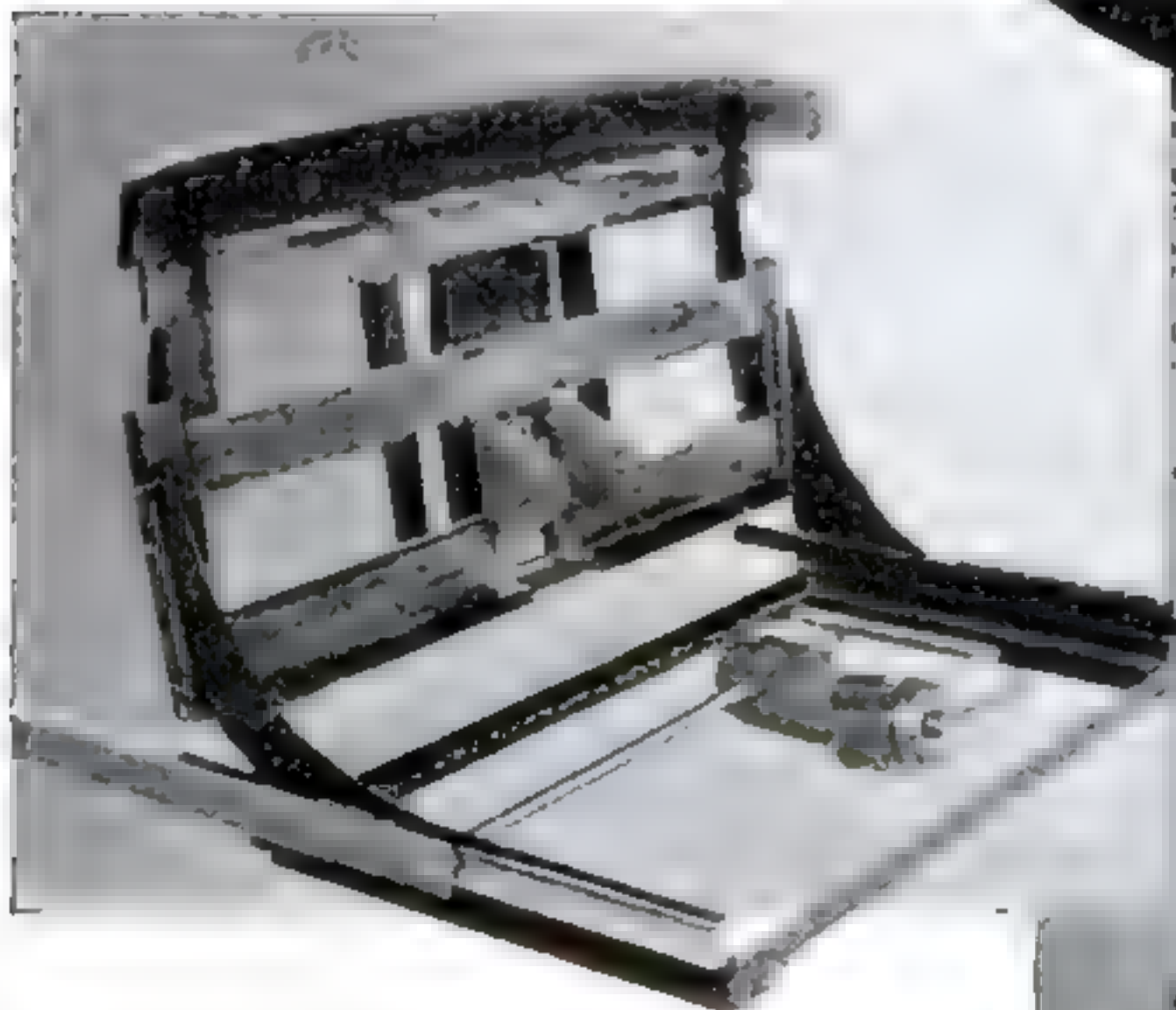
Before construction is started, unusual body designs are drawn full-size on a blackboard for the customers' approval

steering wheel, gear shift, and foot controls on the floor, where a concealed driver, viewing the road ahead through the radiator grille, could weave the roadster safely in and out of traffic with a mystifying effect.

Several requests have been made for concealed jewel compartments, which the firm cleverly met by installing dual batteries, one on each side of the car frame. They appear identical, but one is a realistic dummy with a hinged top that opens to reveal a large



Models, too, show buyers what their cars will look like. Left, a dummy storage battery for hiding jewels. The realistic top conceals a roomy velvet-lined case



Pressing a button in the car at the right causes the rear seat to roll forward flush with the door, making it easy for elderly people to get out. The mechanism is pictured above





SPECIAL SEAT DESIGNED FOR AN INVALID

Twelve-inch range of movement forward and backward, and an adjustable reclining back, give riding comfort for invalids

When the seat is turned outward, as pictured below, a helpless person can be lifted out easily



velvet-lined jewel case to hold valuables.

Many persons come to the California automobile tailors to have trick devices incorporated in their cars for special purposes. One man had a trapdoor built into his car roof so that he could stand up while shooting deer from his automobile. Police cars have been similarly equipped to aid officers when chasing fleeing criminals.

Other car owners want special seats installed. Pressing a button in one sedan starts an electric motor that rolls the rear seat forward and flush with the door, to aid elderly persons to get in and out. Another special job was a front seat designed for a paralyzed invalid. This moves twelve inches forward and backward, tips to a reclining position, and swings sidewise so that the occupant faces outward. The doors on this car are hinged at the front and rear, with the usual center post removed, thus making it easy for a helper to carry the invalid to and from the seat.

A ten-year-old chassis compared with a colored drawing that shows how it is to be transformed

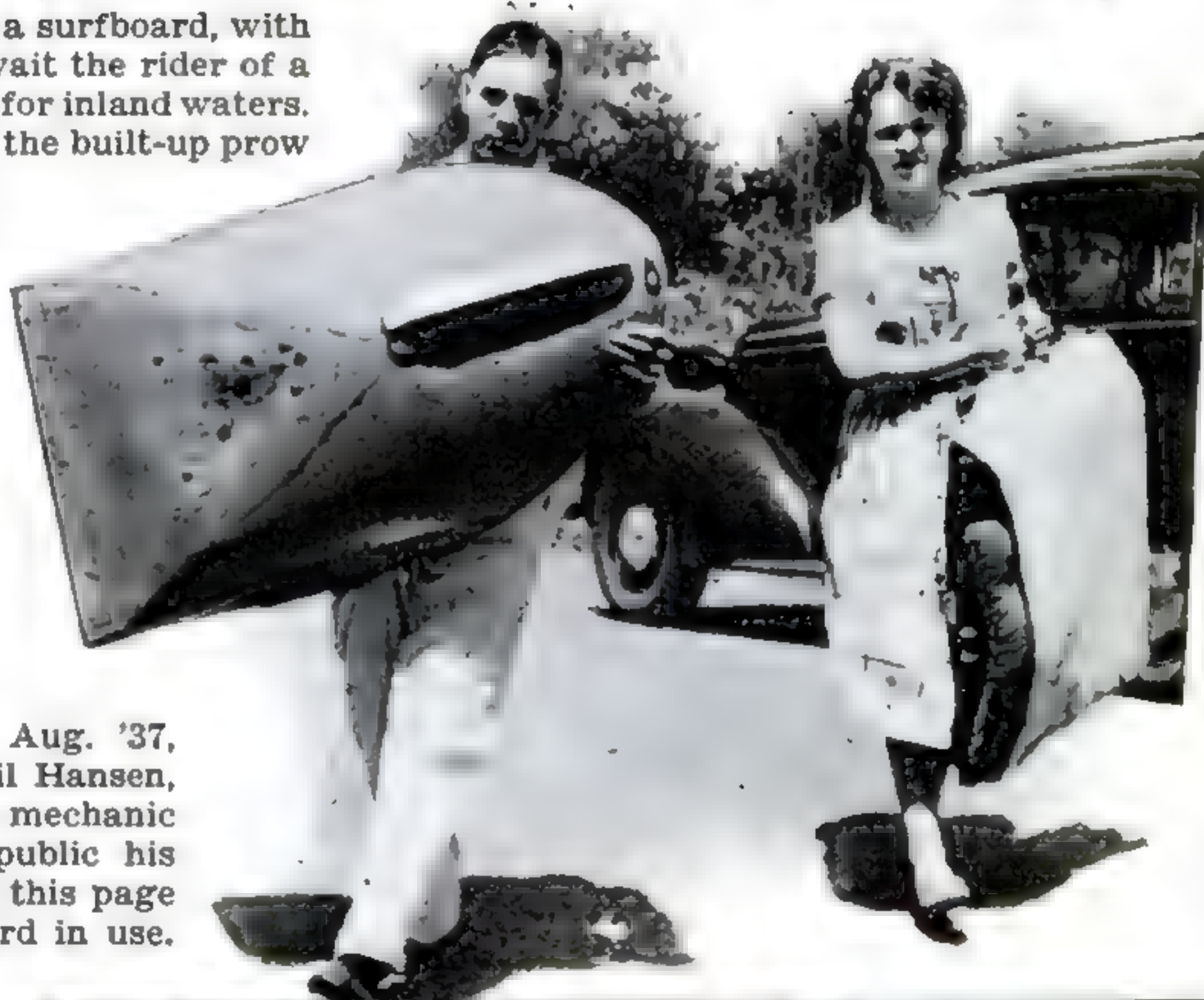




Surfboard riding de luxe. A four-horsepower motor in the prow drives the board at twenty miles an hour

Motor Surfboard Needs No Surf

ALL the thrills of riding a surfboard, with none of the effort, await the rider of a new motorized model for inland waters. A four-horsepower motor in the built-up prow propels the nine-foot "skim board" at a pace up to twenty miles an hour, and the built-in fuel tank holds enough gasoline for an hour's operation. Its four sections come apart readily, making it easy to carry along in a car and assemble at the water's edge. Put together, it weighs ninety pounds. The current model is the outgrowth of plans revealed by this magazine (P.S.M., Aug. '37, p. 59) at the time that Emil Hansen, the inventor, an automobile mechanic of Media, Pa. first made public his novel idea. Photographs on this page show the motorized surfboard in use.



Used like an ocean surfboard, the "skim board" is specially designed for inland waters. It comes apart in four sections so that it can be taken along in a car, as demonstrated by the inventor in the view above



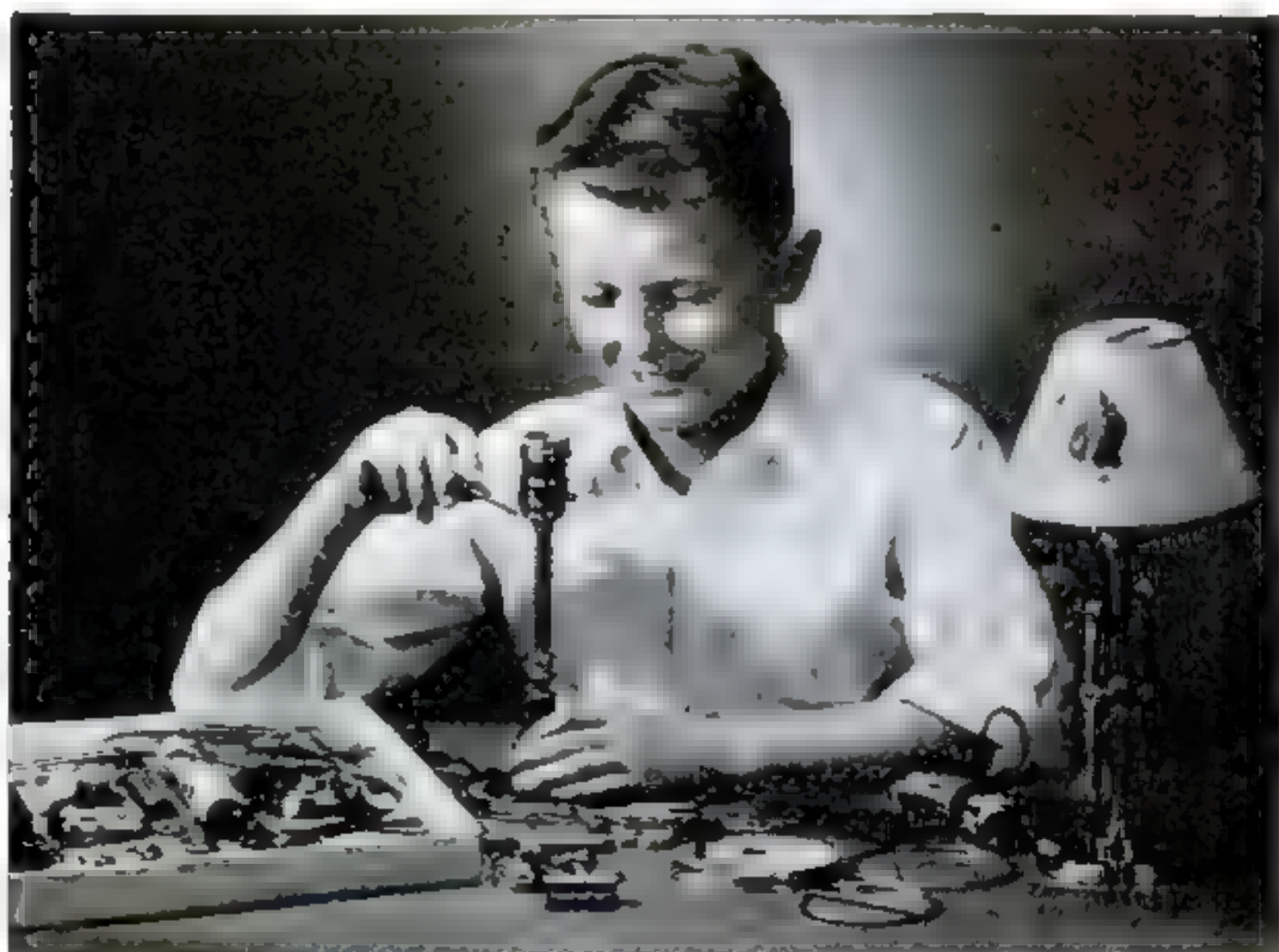
William Badders, Navy master diver, having his helmet adjusted for a test

Divers Breathe Helium To Set Depth Record

BREATHING a mixture of helium and oxygen with which the U. S. Navy and the Bureau of Mines have been experimenting for over twelve years, two Navy divers recently underwent tests in a diving tank at the Washington, D.C., Navy Yard, where they withstood artificial pressures that simulated conditions found at an actual ocean depth of 500 feet, a new world's record. Deep-sea conditions were obtained by partially filling the test tank with water and applying an air pressure equivalent to that at a depth of 500 feet. Both William Badders and J. H. McDonald, who submitted to the tests, wore only conventional diving equipment. Under old methods employing only air, naval officials said, the maximum depth that could be safely attained was about 300 feet, a depth at which divers could remain for only fifteen minutes, after which it was necessary to spend several hours in a special decompression chamber.

Kits Have Materials for Making Lamps

MAKING small table lamps for personal use, or as gifts to relatives or friends, is made easy by complete construction kits recently placed on the market. Each outfit contains a metal base with fittings, bulb socket, current cord, decorated shade, tools, and all other items needed for assembling an attractive lighting fixture. When completed, the lamp makes a serviceable and decorative light for a child's bedroom or playroom, or for use in other rooms of the house. Neatly boxed, the kits contain complete building instructions.



It's fun to build your own lamps with this complete kit



Huge Double-Jointed Bus Carries 140 Passengers

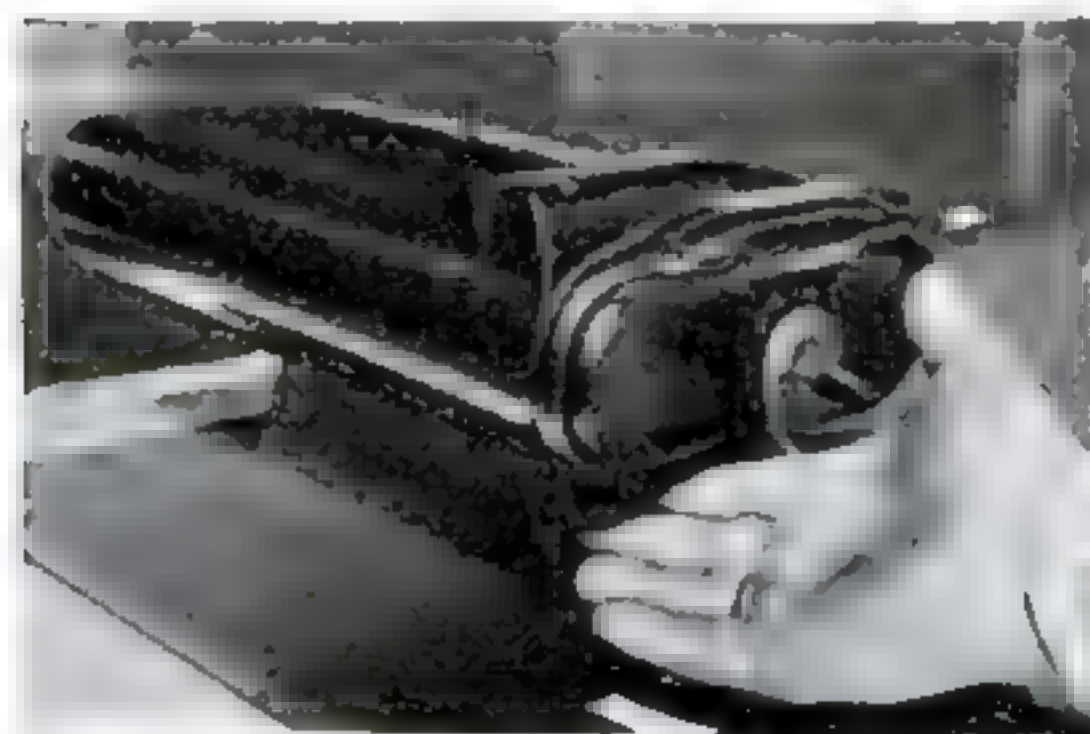
MORE than forty-five feet long, a lightweight, double-jointed bus was recently given a trial on the streets of Akron, Ohio. Designed to carry between 120 and 140 passengers, the eight-wheeled vehicle is built in two sections that are connected together like

railroad cars, with a flexible rubber hood covering the joint. The Siamese-twin bus is made of aluminum and is said to give passengers a smooth, bumpless ride even at a speed of fifty miles an hour. The makers claim it is able to turn within a surprisingly short radius.

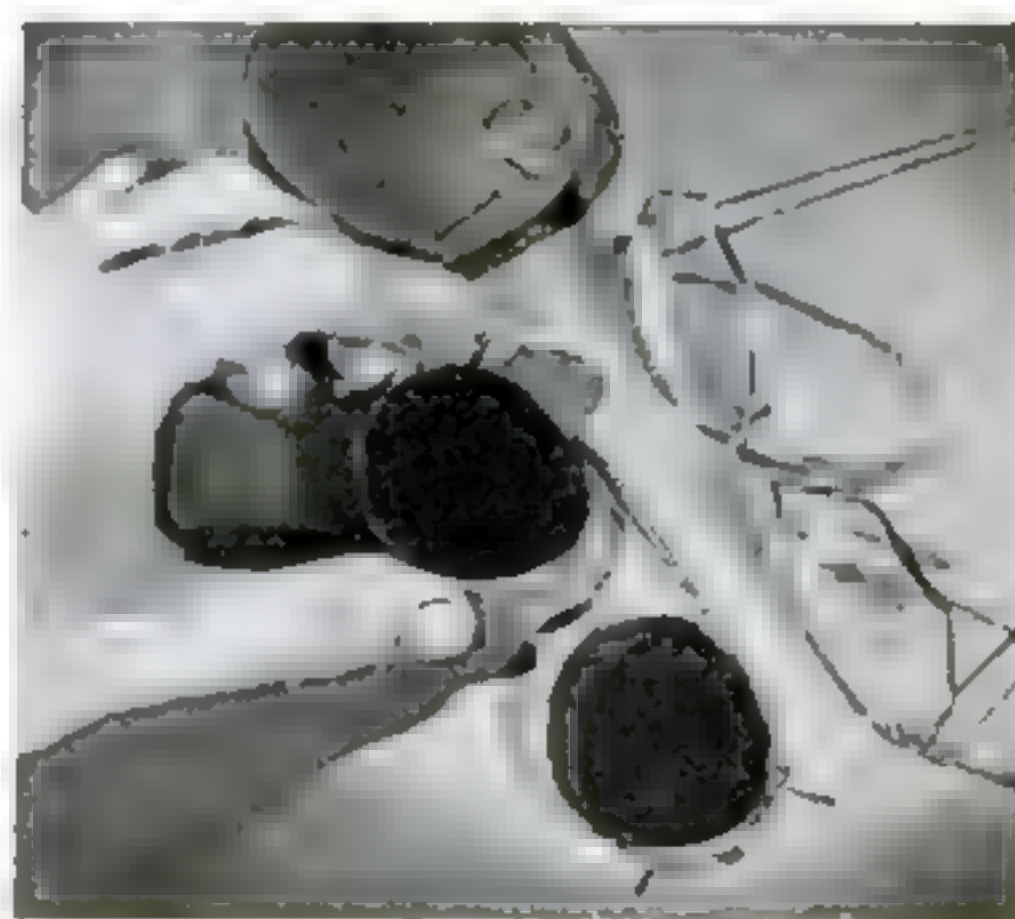
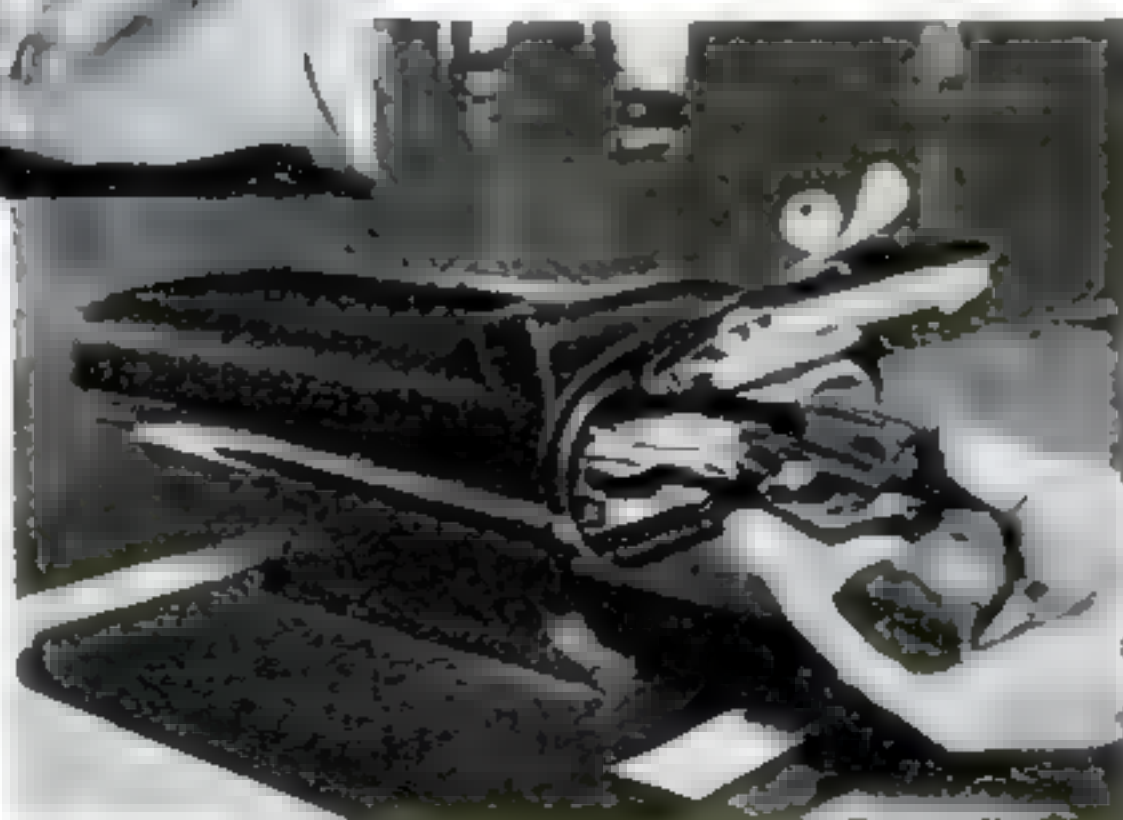
Holster Snaps Gun into Cop's Hand

EJECTING a revolver at the touch of a lever, a novel quick-action holster is designed especially to fit under the dashboard of police cars. The device has a locking mechanism that holds the gun safely in place when not in use. When needed, however, there is no delay in removing the revolver from its holder, since an officer merely flips his

hand against the release lever, the cover flies open, and a spring mechanism shoves the gun directly into his hand in a position for instant use.



How the automatic holster works. Touching a trip catch on the spring lock with one finger, as above, instantly ejects the revolver into the hand in a natural position for immediate use



Polarized Lenses Clip to Glasses

PERSONS who wear eyeglasses can now obtain clip-on polarizing lenses for protection from the glare of strong, reflected light. The one-way-light lenses are especially useful to motorists, since the special glass blocks the glare of sunlight or car headlights reflected from the roadway. They may also be used like conventional sun glasses.



Air-Conditioned

Central Hot-Air Heating System

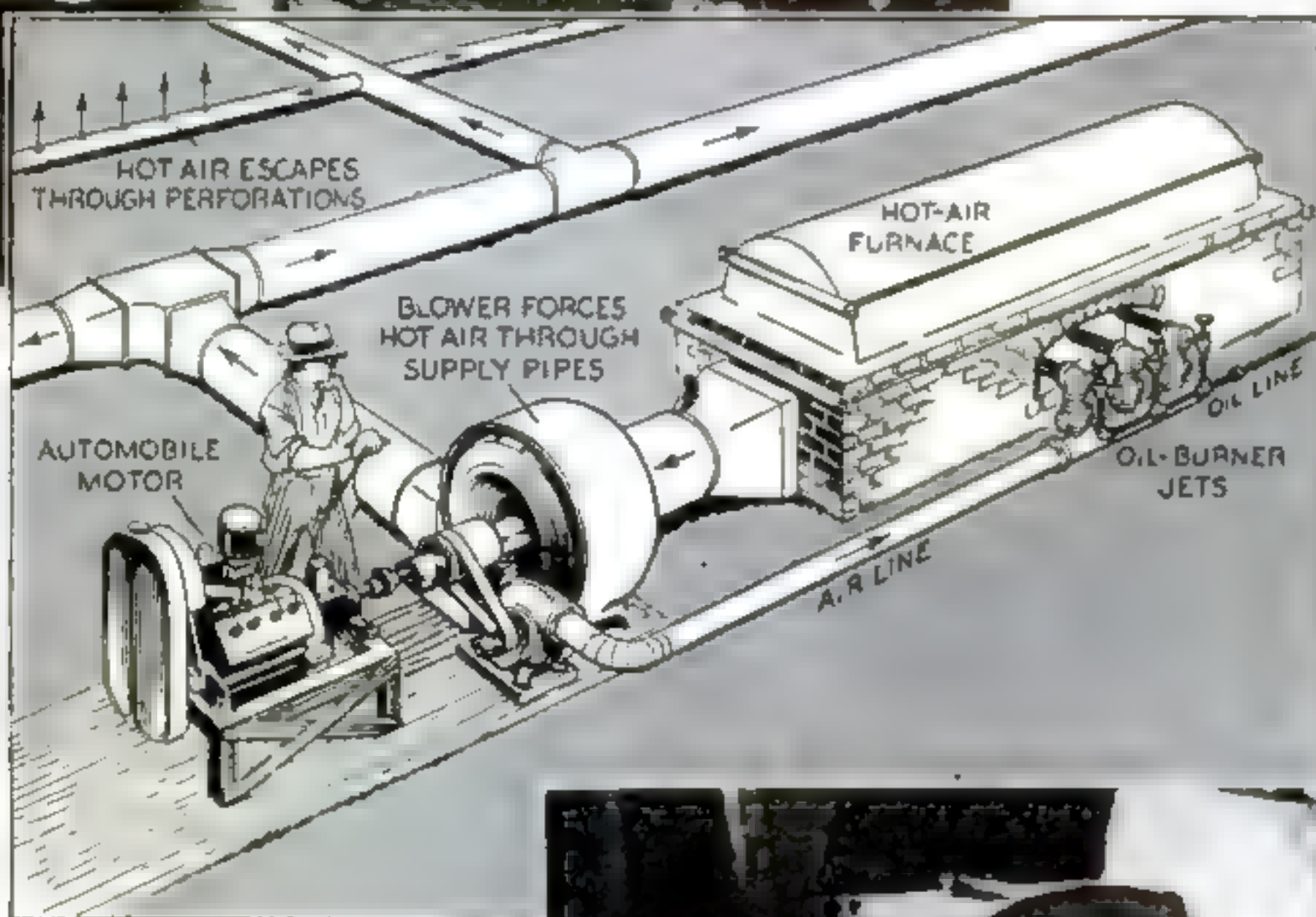
Pipes Warmth to Trees To Save

Citrous-Fruit Crops from Frost

BLASTS of hot air, issuing from pipes to swirl around tree trunks and rise through the branches, now save valuable citrous-fruit crops from destruction by frost. Devised by D. F. Ainslie, California inventor, the novel orchard-heating system utilizes a central oil-fired furnace unit, from which the hot air is piped to all parts of the grove. An eight-cylinder automobile engine drives a large circulating fan and provides power for the oil-burner blower. Photographs on these pages show an installation in the five-acre lemon grove of H. E. Passig at Claremont, Calif.

Large, insulated pipes run from the brick heating unit down between the rows of trees, while smaller pipes branch off to run beneath individual trees. The small pipes are perforated for a distance of six feet beneath each tree so that escaping warm air can circulate under, and up through, the branches. Pipe perforations increase in diameter with the distance from the main supply pipes to allow for an even distribution of the heated air.

Tests have shown that the hot-air furnace, which burns inexpensive fuel oil, can generate blasts of air as hot as 400 degrees F.,



Hot-air pipes in the lemon grove of H. E. Passig, at Claremont, Calif., seen at the top of the page, are supplied by the heating system illustrated in the drawing above. At right, D. F. Ainslie, inventor of the system, is adjusting one of the three oil burners in the central furnace

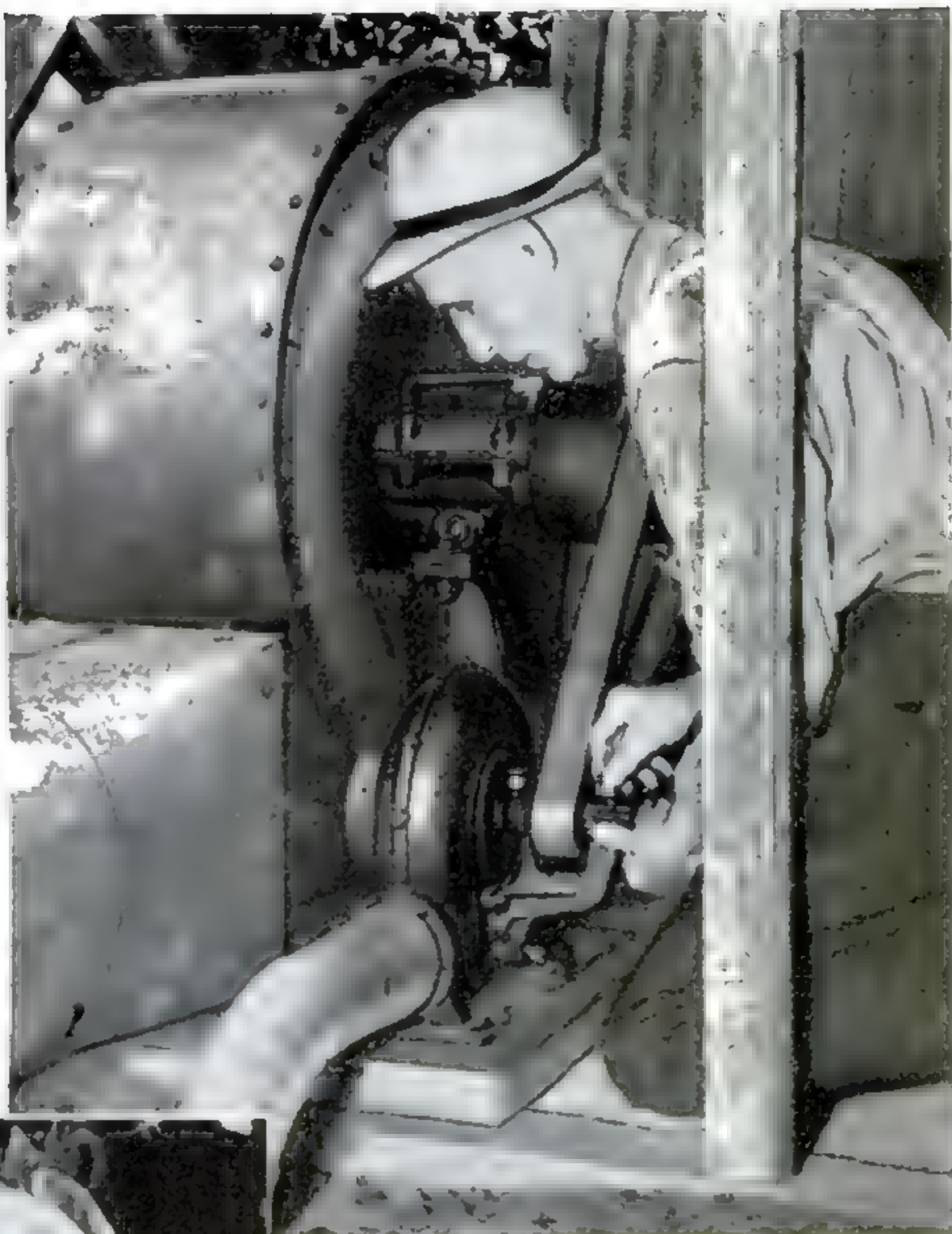


Orchards

much warmer than would ever be needed even under extreme conditions. The blowing apparatus can circulate 7,000 cubic feet of hot air a minute through the system, Ainslie states, at a cost that is much lower than the method of individual oil burners and smudge pots now in common use. For a ten-hour operating period, the orchard-warming system will use from seventy-five to 100 gallons of fuel oil at a total cost of approximately four dollars.

Upkeep and operating cost of the system are low, the inventor claims, since it requires no cleaning, adjusting, or refilling of individual oil-burning units.

By R. T. NIMMONS



The fruit grower examining a grease cup on the blower that pumps air through the pipes. A gasoline engine runs the fan



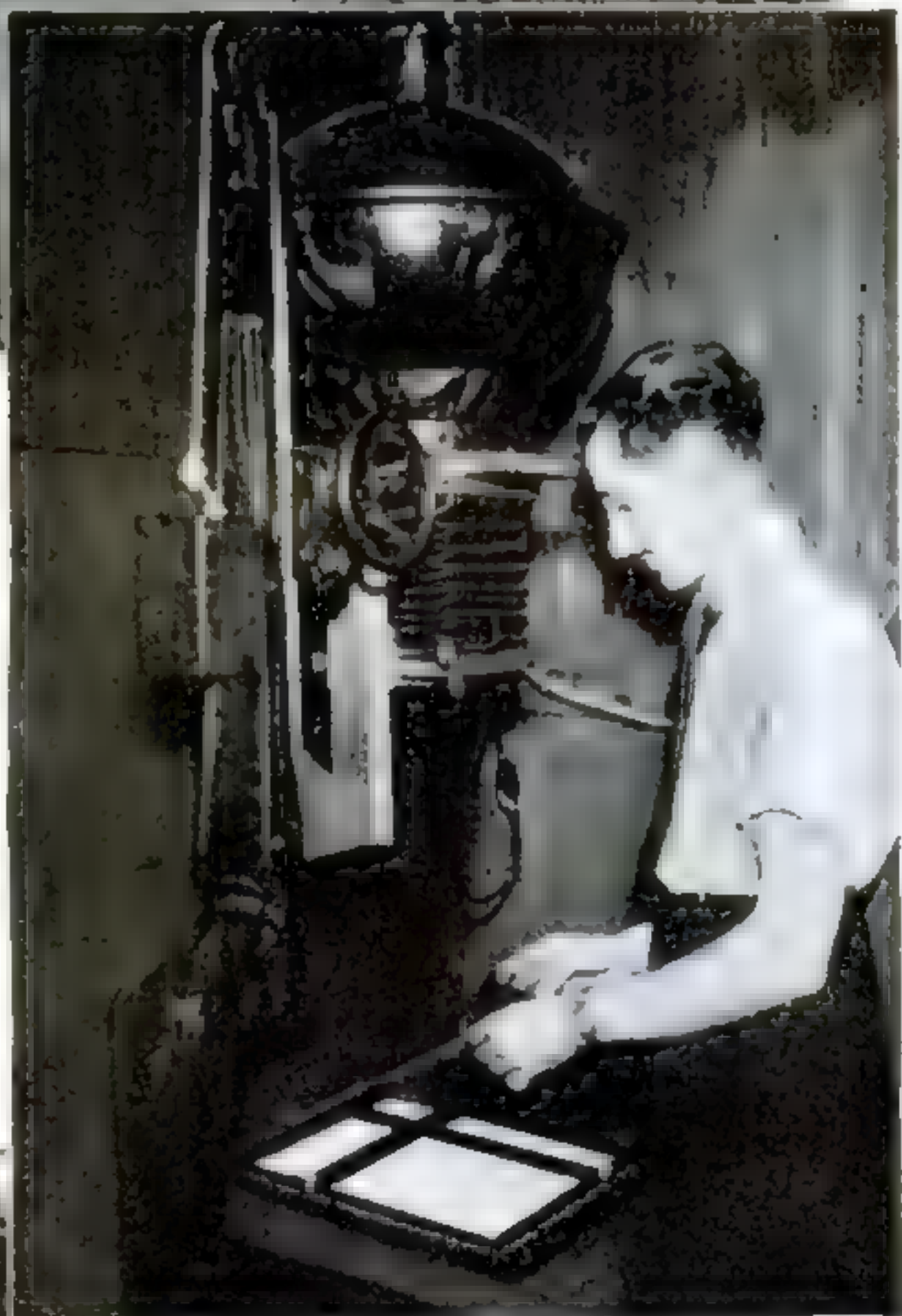
Pipes under individual trees are perforated to allow the hot air to escape and rise among the branches. At right, Ainslie measures the opening of his economical oil burner





Camera Fans Rent Darkrooms and Studios by the Hour

DARKROOMS provided with running water, developing trays, and enlarging equipment are now available on an hourly rental basis at the headquarters of a New York City photographic-supply house. The firm furnishes a free film-washing and drying service, and has a studio with lights, camera, and backgrounds for rent at a moderate fee. The darkroom service is designed especially for amateur photographers who do not have adequate working space at home.



An amateur photographer making enlargements with equipment for rent at a New York City photographic-supply house. The picture at top of page shows one of the completely equipped studios that also are available to fans who do not have room to work at home



At the left, a group is seen at work in a by-the-hour darkroom. Adequate facilities are provided



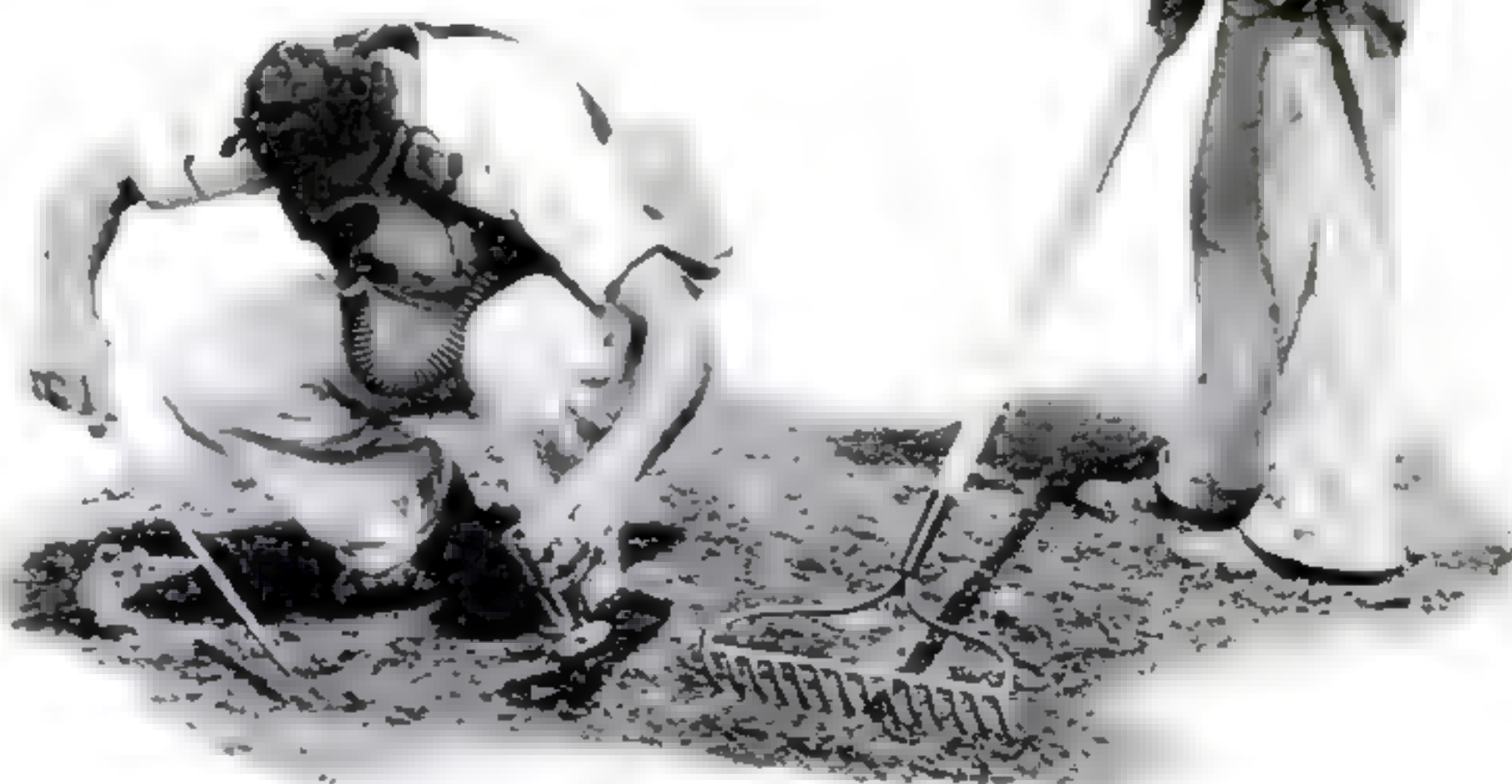
Despite the knot tied in this elm tree years ago, it still flourishes

Freak Tree Has Knotted Trunk

TIED in a knot when it was a seedling, one of the odddest of freak trees flourishes on a farm at Tomah, Wis. Though the trunk of the ten-year-old American elm has attained mature thickness, it still preserves the unnatural form that it was forced to assume. Neither the knot nor a further handicap the tree received when it was struck and gashed by a farm truck several years ago, seems to have interfered seriously with the healthy growth of the tree, which is shown with its owner in the picture.

Experimenters Test Poison Gas in Warfare Against Weeds

POISON gas may soon have a new use, if Government experimenters succeed in current attempts to kill weeds with it. Their method consists of "gassing" soil and turf with an oily liquid called chloropicrin, which vaporizes to form one of the principal lethal gases used in the World War. After masked workers pour the fluid on the ground, they rake over the area and cover it with large sheets of paper, to delay the escape of the gas. The experimenters foresee application of the scheme to golf-course greens.



Experimenters wearing gas masks apply a lethal fluid to the soil



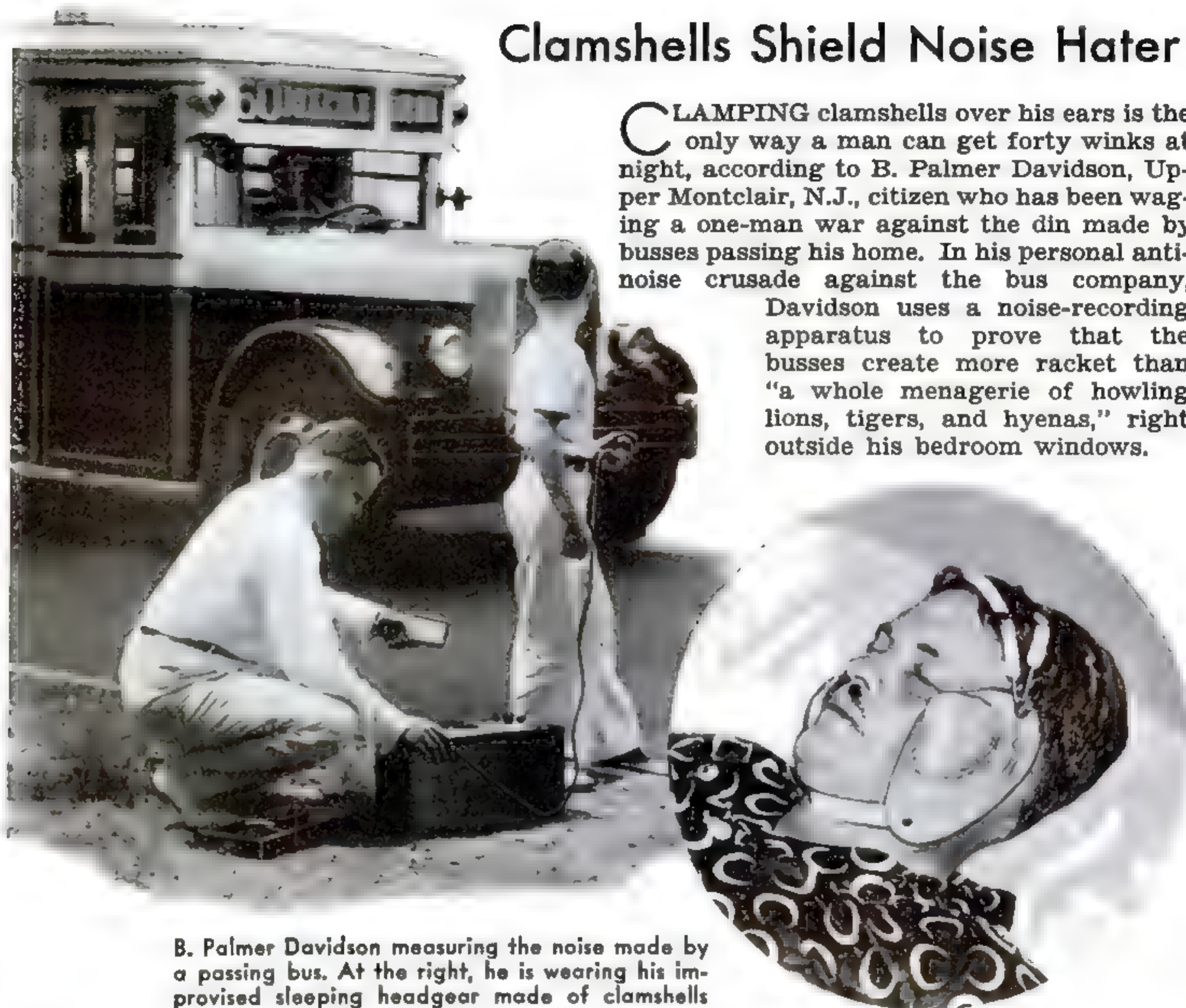
How the heater fits in hot-water bag

Heater Unit Fits in Hot-Water Bag

HOT-WATER bags stay hot as long as needed when fitted with a new electric heating unit that plugs into any household outlet. The device replaces the standard screw cap of a bag. Set to high or low heat by turning a knob on its side, a built-in thermostat maintains the desired temperature. In the illustration, a portion of the bag has been cut away to show the manner in which the heating unit fits into it.

Clamshells Shield Noise Hater

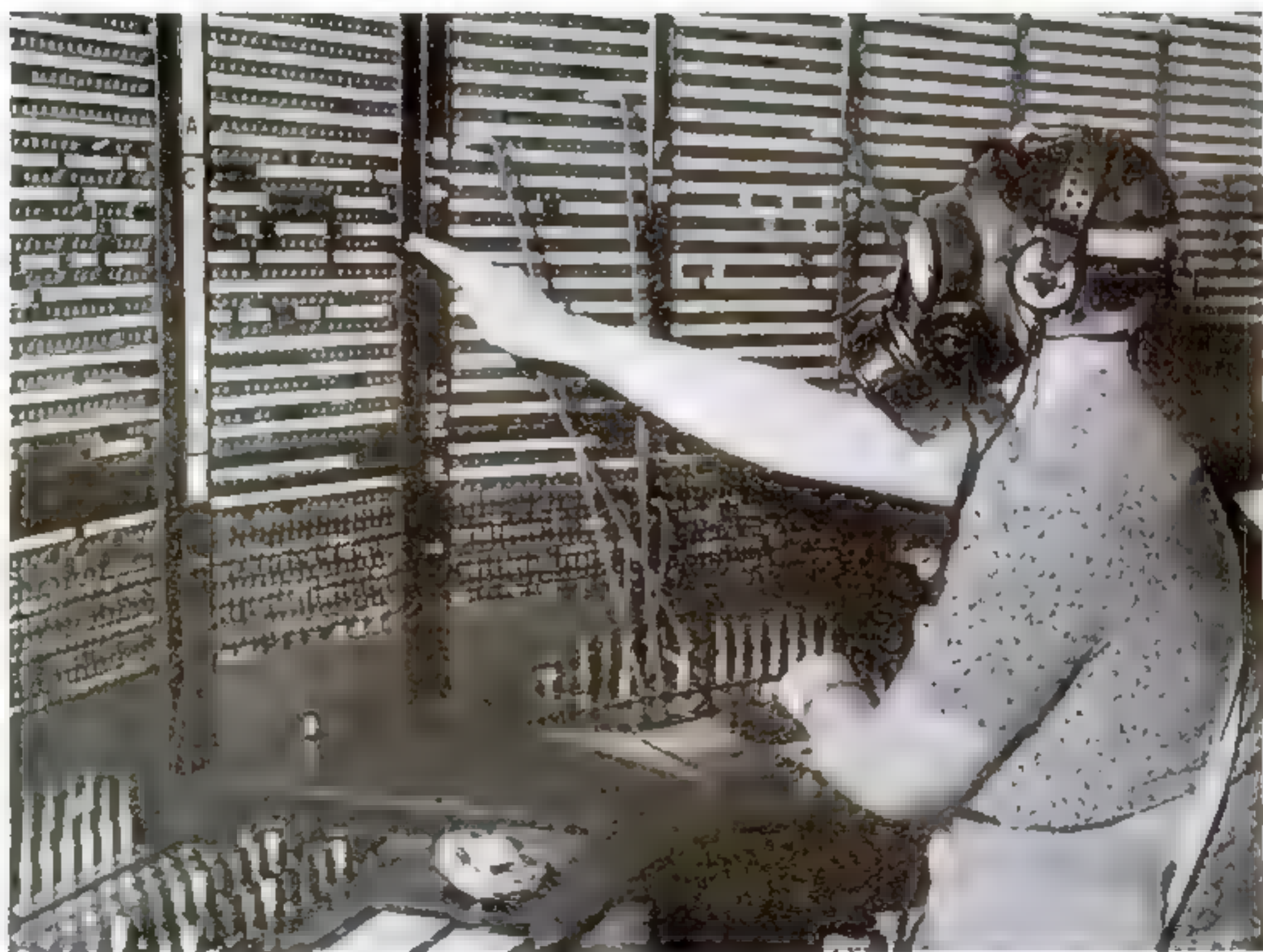
CLAMPING clamshells over his ears is the only way a man can get forty winks at night, according to B. Palmer Davidson, Upper Montclair, N.J., citizen who has been waging a one-man war against the din made by busses passing his home. In his personal anti-noise crusade against the bus company, Davidson uses a noise-recording apparatus to prove that the busses create more racket than "a whole menagerie of howling lions, tigers, and hyenas," right outside his bedroom windows.



B. Palmer Davidson measuring the noise made by a passing bus. At the right, he is wearing his improvised sleeping headgear made of clamshells

Phone Girls Get Gas Masks for Air Raids

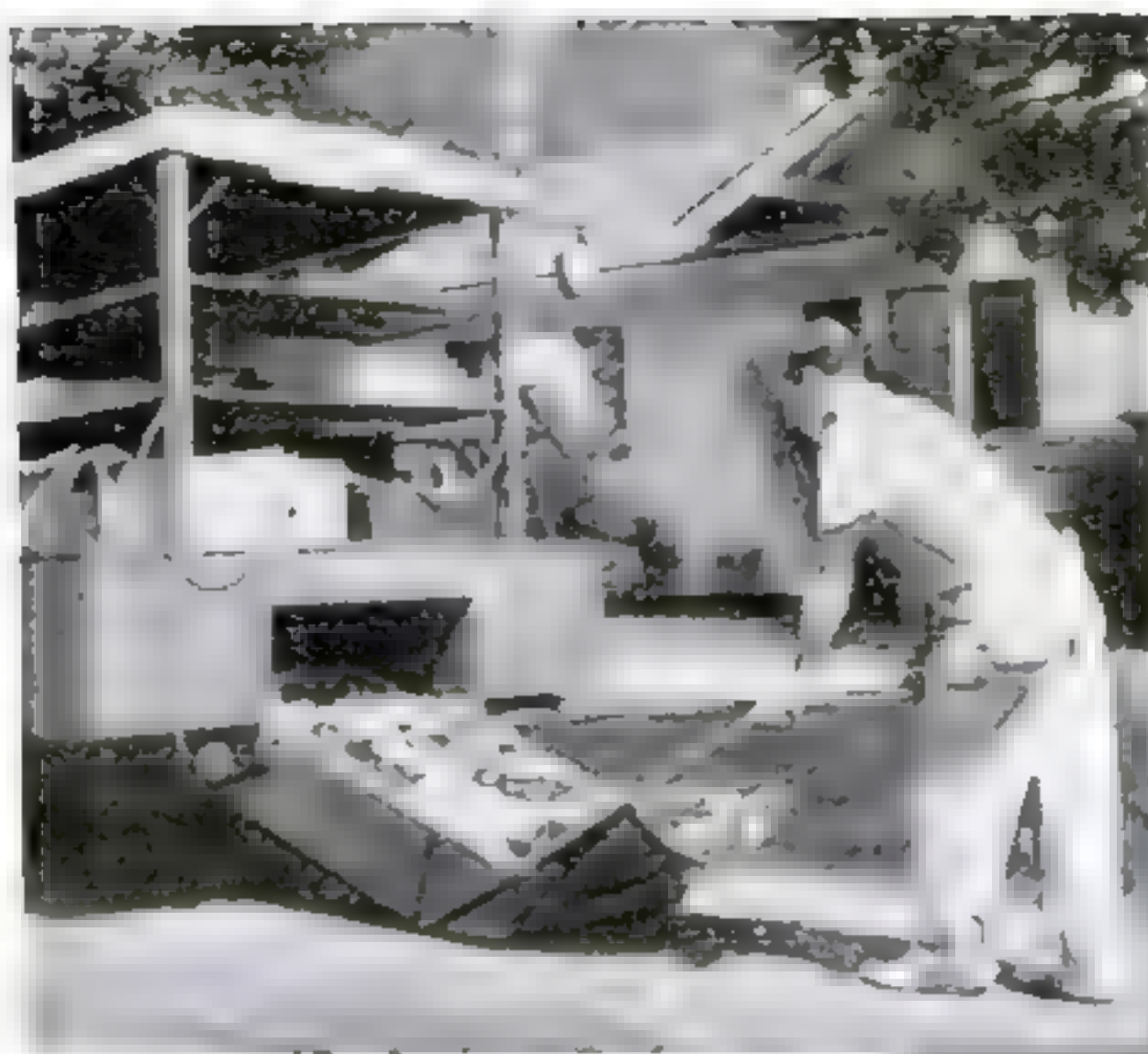
SO THAT telephone service, vital to military and civil authorities in case of wartime air raids, may be maintained in spite of the presence of poisonous gas, special gas masks have recently been designed in England for the use of telephone-switchboard operators. Strapped around the head, the masks are fitted with built-in telephone mouthpieces, earphones, and eye openings covered with glass to enable the operators to talk, hear, and see their switchboards despite gases that may seep into the telephone control rooms.



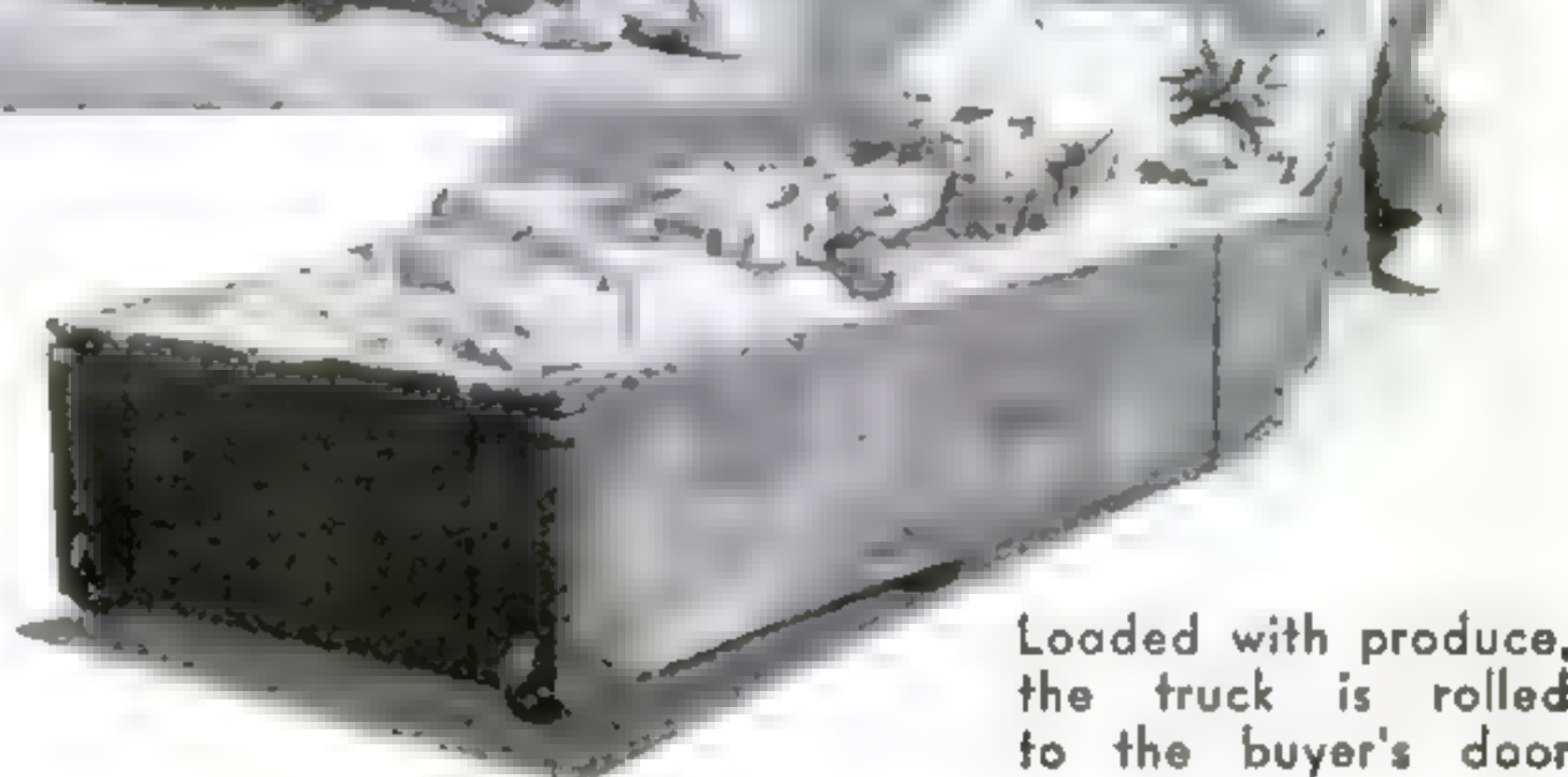
This mask for switchboard operators has built-in earphones and mouthpiece

Hand Truck Is Rolling Fruit Store

ROLLING on six wheels, a metal hand truck which carries 100 fruit and vegetable items enables W. K. Gilmore, produce peddler of Pasadena, Calif., to carry samples of all his wares from his delivery truck to the back doors of his customers. The portable container fits within a recess at the rear of his truck, locking automatically in place when not in use. It balances on two center wheels, with smaller wheels at the ends for climbing curbs. This convenient method of display has increased his sales considerably, Gilmore states.



W. K. Gilmore removing his hand truck from its recess in the big delivery car



Loaded with produce, the truck is rolled to the buyer's door

Old and New Meet on the Mississippi

NEW and old are contrasted in the photograph reproduced below, showing an old-time stern-wheel steamboat of the type once common on the Mississippi River, tied up on the levee near St. Louis, Mo., close to a modern streamline passenger vessel of the latest type. Note that the modern river steamer has decks completely inclosed, and few projections that could stir up air resistance when the steamer is under way. Many of the old river boats are still in use.



An old-time stern-wheel river steamboat, tied alongside a modern streamline craft



Quacking

HOSPITAL FOR DUCKS

If a duck got sick, before our modern times, there was no one to take his pulse, look at his tongue, or dose him with medicine. Today, a "duck hospital" at the Bear River Migratory Waterfowl Refuge in northern Utah treats the ailments of thousands of wild ducks each year. Most of the patients of the "quack doctors" recover.

At the 64,000-acre bird refuge, five lakes and the Bear River marshes offer what should be an ideal haven for waterfowl traveling south for the winter. When the hospital was established, however, a mysterious plague was killing off hundreds of thousands of ducks yearly. Now the cause of the disease has been found and it is being brought under control. In addition, the hospital's doctors care for "emergency cases" of every description among the 200 species of birds that use the refuge, including not only ducks but Canada geese, white swans, pelicans, and ring-necked pheasants.

A Canada goose trying his wings at the convalescent pond of the U.S. Migratory Waterfowl Refuge in northern Utah, after being treated for western duck sickness

DEPARTMENT OF AGRICULTURE
BIOLOGICAL SURVEY

**U. S.
MIGRATORY
WATERFOWL
REFUGE**

**HUNTING TRAPPING
TRESPASSING
PROHIBITED**

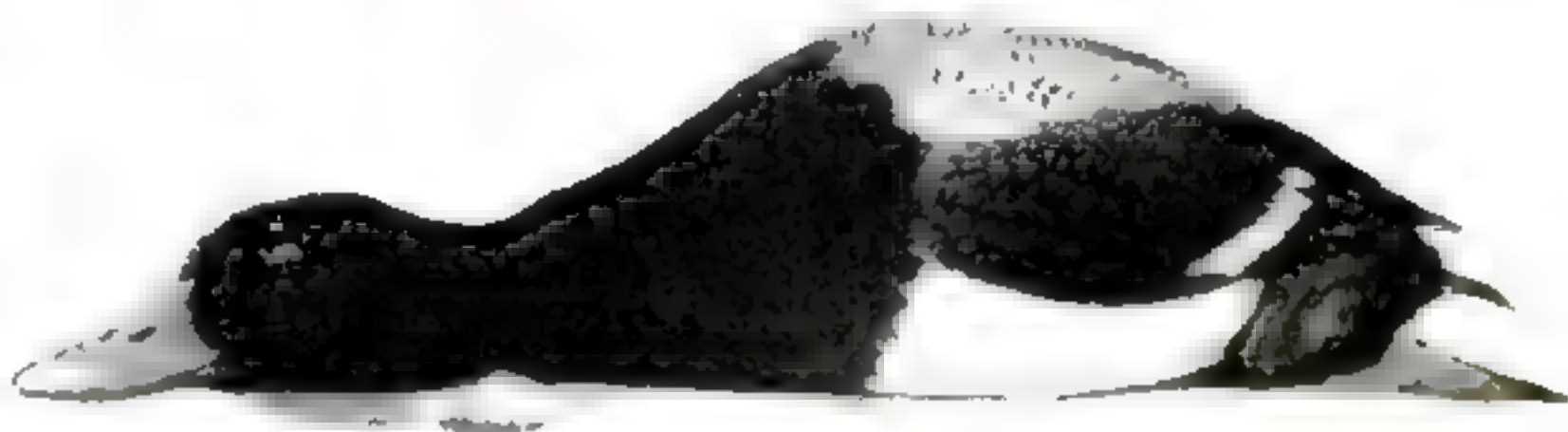
**\$500 FINE SIX MONTHS
IMPRISONMENT OR BOTH
FOR MOLESTING WILD LIFE
OR PROPERTY DAMAGE
ON THIS RESERVATION**



the Quackers

CURES MIGRATORY WILDFOWL OF MYSTERIOUS DISEASE

Brought in by CCC boys from the marshes, batches of sick and dying water birds are installed in "wards" consisting of rows of frames covered with wire screening. After expert diagnosis of their complaints, they receive individual treatment. If a duck or swan is found suffering from lead poisoning, water forced into its stomach with a bulb and hose washes out dozens of lead shotgun pellets that it has gulped down in its search for food in areas where shooting is permitted. A dose of medicine from a tall glass graduate, instead of a spoon, cures a pelican troubled with stomach parasites, or "worms." A weak solution of Epsom salts, administered with



A sick duck picked up in the Bear River refuge

the hose and bulb, frees a duck's system of the poisons of "western duck sickness," or botulism. After the treatments, the patients regain their health and strength in a "convalescent pond" until they are sufficiently recovered to take wing again.

Western duck sickness was the baffling malady that took by far the heaviest toll of

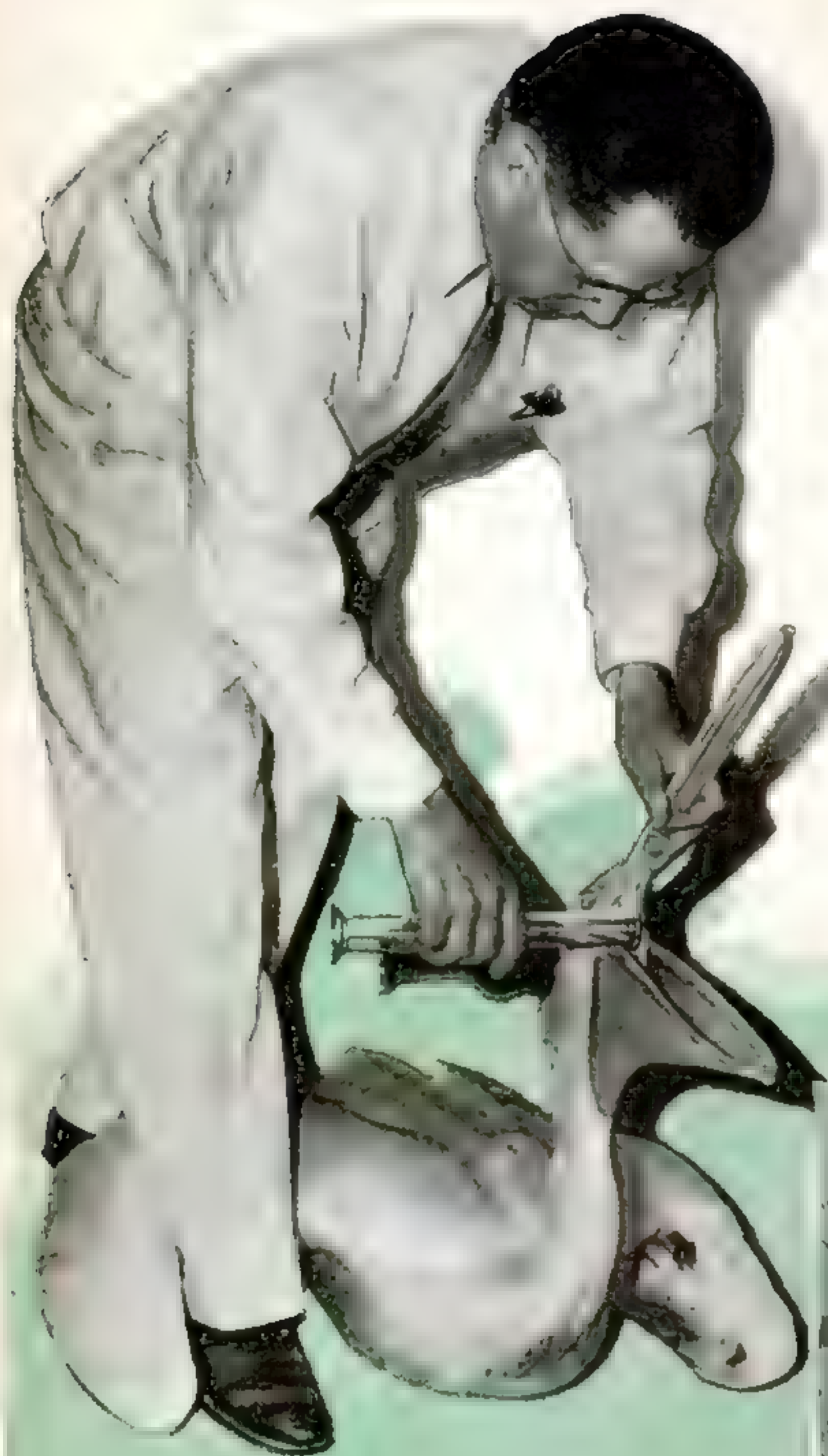
By DAVID H. MANN

Dr. D. R. Coburn, at left, and Dr. E. R. Quortup irrigating the stomach of a white swan. Water forced in with a bulb and hose washes out shotgun pellets the bird has swallowed with food



A U.S. Biological Survey agent shows the migratory range of wildfowl that visit the Bear River refuge, as revealed by reports from hunters who have shot down banded birds





A pelican gets a dose of medicine for stomach parasites, or worms. Below, a group of Canada geese in the convalescent pond. Brought to the hospital nearly dead, they are now almost well

the duck population. Men were employed to shoo ducks away from certain stagnant pools where it seemed to be especially prevalent, but the mortality continued year after year. Then E. R. Kalmbach, a Government biologist of Denver, Colo., found the malady to be a form of botulism, or food poisoning, caused by a certain rod-shaped disease germ. Aided by this vital clue, Dr. D. R. Coburn and E. R. Quortup traced the trouble at the Bear River refuge, where they found the germ inhabited the slimy ooze at the bottom of the marshes. It remained comparatively harmless unless the marsh frequently dried up—a condition aggravated by recent diversion of water for irrigation.

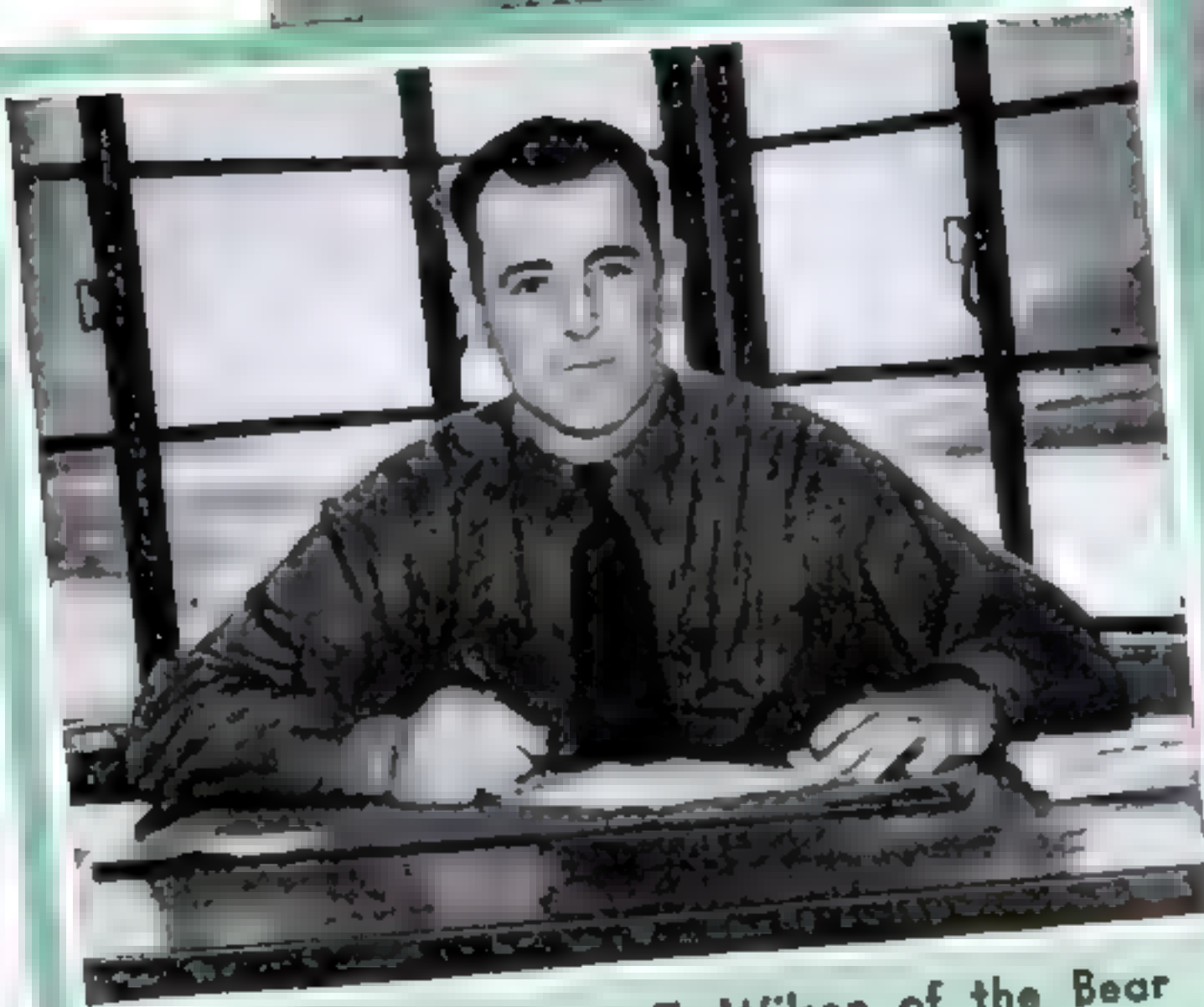
The solution, the research workers found, was simply to prevent the marshes from drying out and to keep them well flooded with a plentiful supply of cool, fresh water. They hope in time to stamp out the disease completely.

Below, a dead goose goes into the refrigerator—not for eating, but to be preserved for dissection and study





This is the research laboratory of the duck hospital, where the latest scientific equipment aids the "quack doctors" in their studies



Superintendent Vanez T. Wilson of the Bear River refuge is in charge of the protection of wild life and the warfare on the duck disease

Ralph Winslow, assistant superintendent, has personally "attended" 6,000 sick ducks during the last three years. The duck shown below died of lead poisoning. The pellets in the glass tube, amounting to the load of an average shotgun shell, were recovered from its stomach



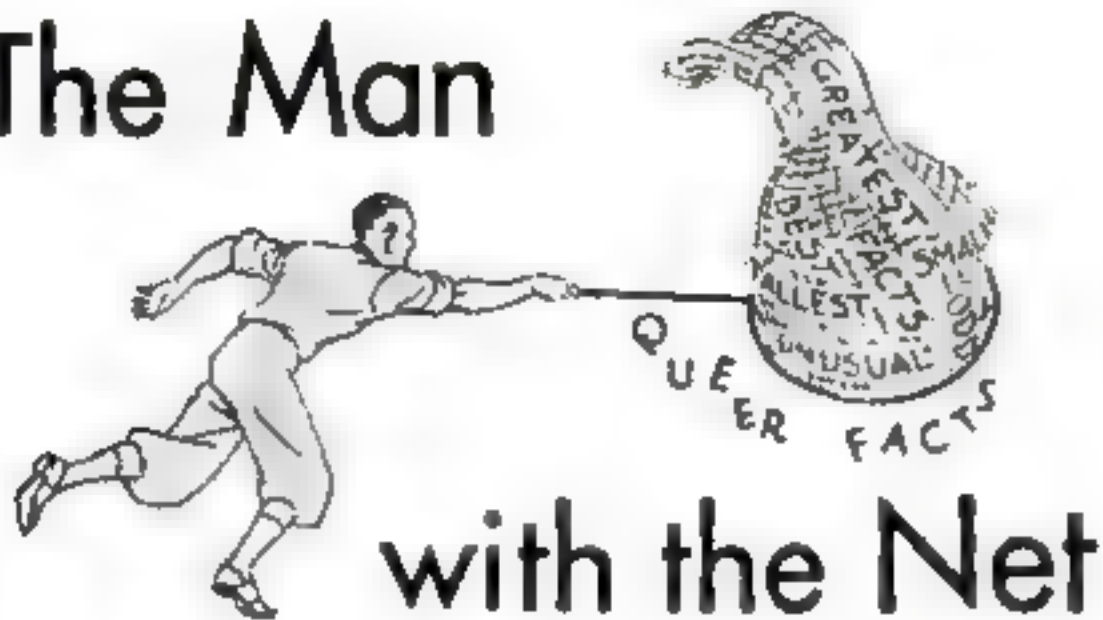


Coxswain Coaches Rowing Crew from Bike on Shore

EIGHT oarsmen of a crew representing Yale University, New Haven, Conn., in practice for a recent race held in England, were coached by their coxswain who rode a bicycle along a path bordering the boat-

race course. From his two-wheeled mobile observation post along the river bank, the coxswain spotted flaws in technique, and shouted corrections to crew members through a megaphone attached to his head.

The Man

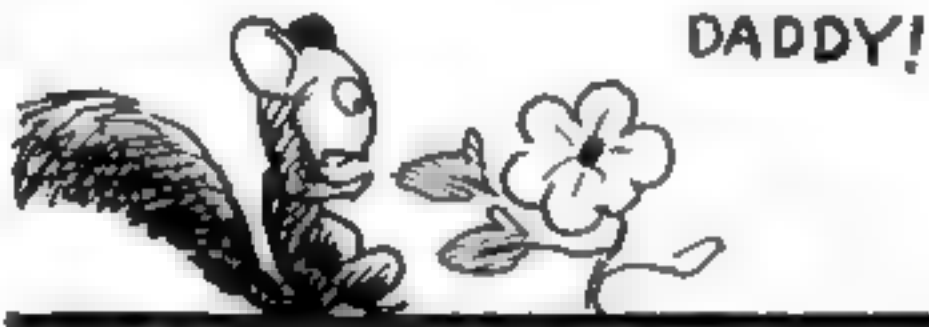


with the Net

AMERICAN surgeons perform 1,000,000 operations a year. Approximately one third of them are for the removal of tonsils.

TIDES in the Okhotsk Sea, in north-eastern Asia, occur twice on some days, only once on others.

SQUIRRELS, bats, and mice, as well as insects, pollinate flowers.



100,000 letters without addresses were mailed last year in the United States.

AIRPLANE DOPE is replacing plaster of Paris in making casts to support the limbs of patients suffering from arthritis.

COW TREES in South America yield a white, milklike sap which is sweet and nourishing.



TERMITES sometimes mate for life, and the kings and queens of colonies have been known to live together for as long as a quarter of a century.

NITROGEN obtained from sardines is being used to make high explosives for Japanese bombs.



Stratosphere Masks Tested

LIGHT in weight, a rubber nose mask fitted with an artificial lung and connected by flexible tubes to a central oxygen supply, was recently tested by air-line officials on a substratosphere flight. The lightweight mask may soon be used by passengers on transport planes flying at high, substratosphere altitudes.

Grows Peas from Tut's Tomb

PEAS now growing in the vegetable garden of A. A. Aldridge in London, England, originated from seeds found in the tomb of Tut-ankh-amen, Egyptian king who died in 1328 B.C. Pods on the curious plants are dark blue, while the peas are lighter in shade than those common today.



These peas were grown from seeds 3,000-odd years old

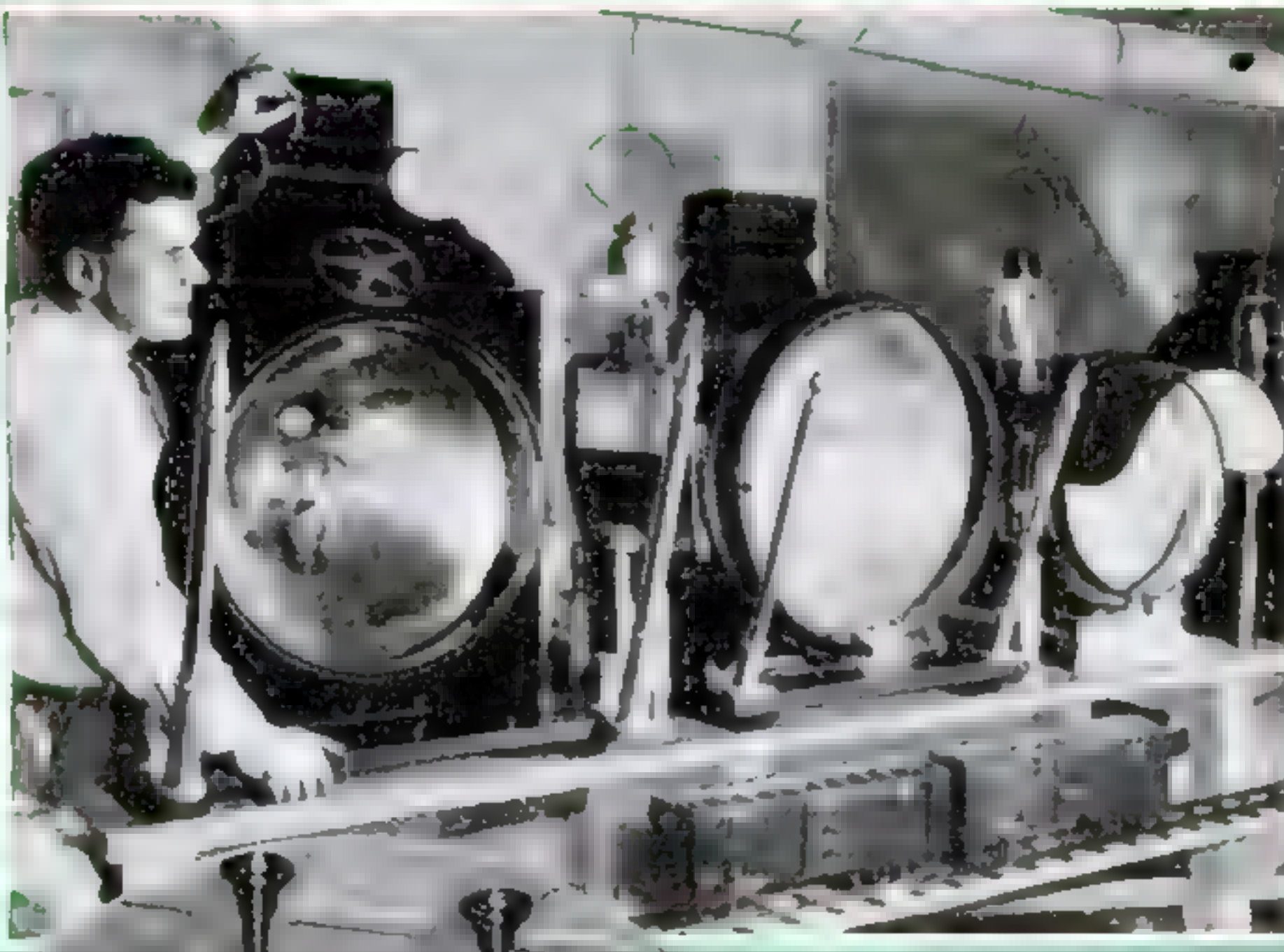
Thomas T. Taber, Jr., shares his father's interest in railroading. Here he is examining a working model of an old locomotive of about 1900



Taber (aloft) inspecting a semaphore signal set up on his lawn. At the right, he is at the control board of his model-railway line

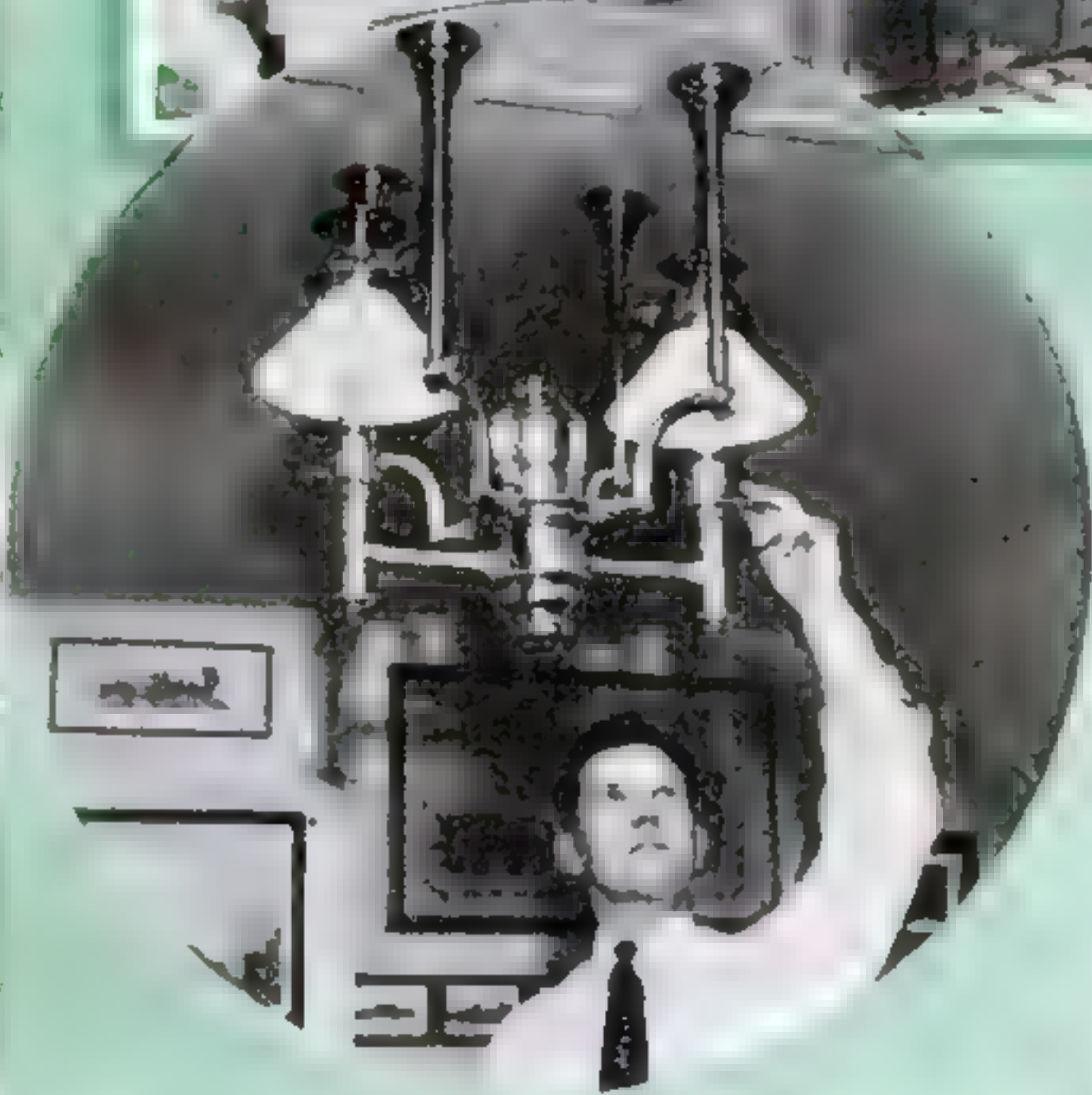
Railroad Fan



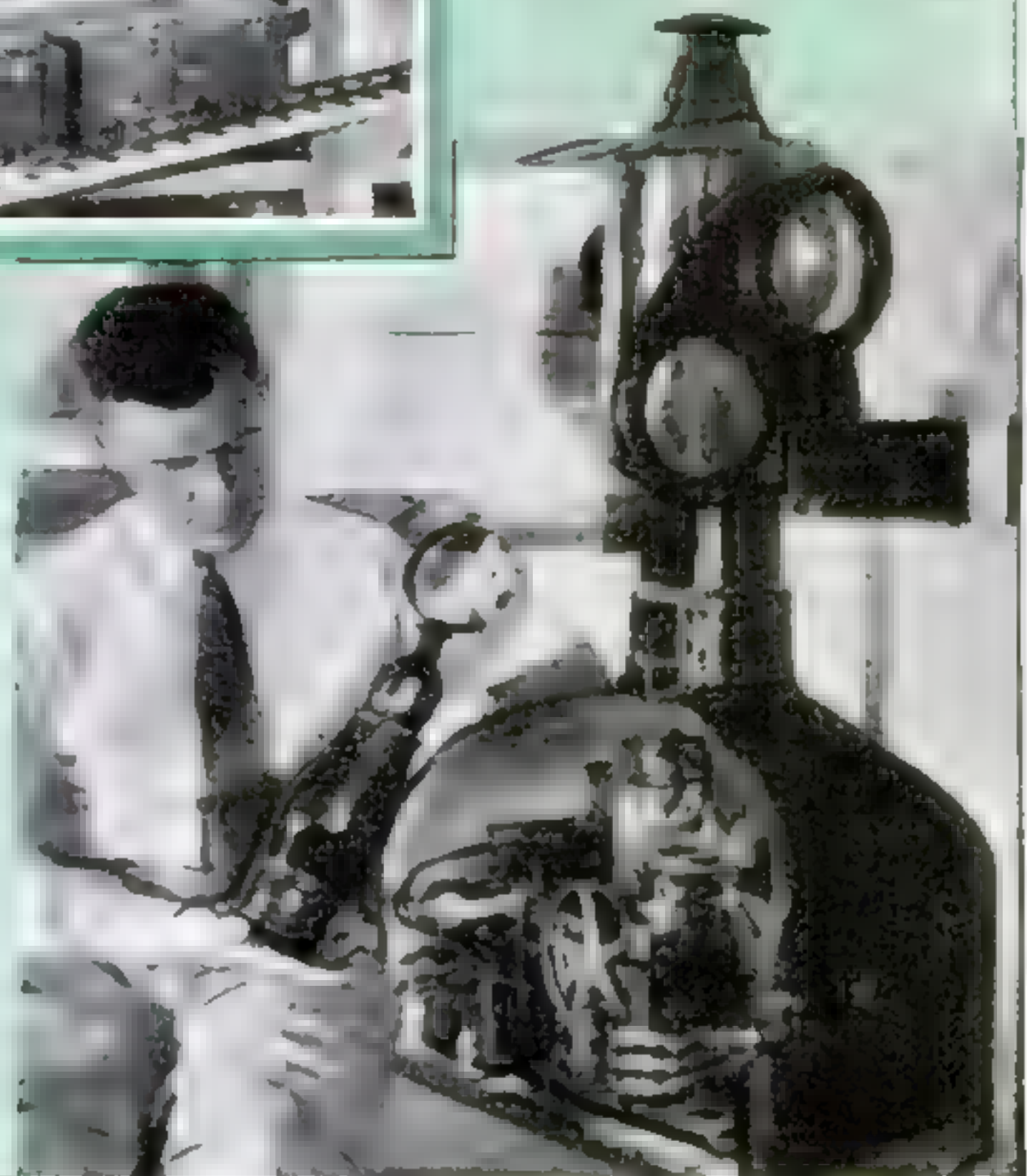


Headlights from real locomotives are included in the unusual collection. A few of them are seen at the left. The two larger ones were lighted by oil

Below: milestones in the development of safety signal devices. Sitting beside the mechanism of a modern semaphore, Taber is holding a red trainman's lantern of Civil War times



Oil lamps from an old coach illuminate his study



Collects Relics of the IRON HORSE

TWO semaphore signals which once saw service on a large eastern railroad now stand on the lawn of the Madison, N.J., home of Thomas T. Taber, an insurance-company official. If the red signal shows, visitors know that Taber is not at home, but if the signals are green, they know that he is inside the house, probably working on some feature of what has been called the greatest private collection of historical railroad material in the United States. Locomotive headlights of both oil and electric types, engine bells that weigh as much as 200 pounds each, old oil coach lamps, switch markers, scale reproductions of ancient locomotives, and hundreds of other priceless historical items relating to the de-

velopment of American railroad transportation are contained in the amazing one-man home museum.

The Taber family's dinner gong is an old locomotive bell mounted on a table in the hall. An old-fashioned oil-lamp lighting fixture salvaged from a junked passenger coach illuminates Taber's study. Carefully filed away in a wall cabinet are thousands of photographs of locomotives, complete with their life histories. Part of one room is given over to an elaborate miniature-railroad system controlled from a central switchboard, and the

wall space is crowded with train lanterns, live-steam models of historic locomotives, and builders' name plates stripped from iron horses long since broken up for scrap.

But this extensive collection is only one phase of Taber's railroad hobby, for a short time ago he rescued an ancient Delaware, Lackawanna & Western locomotive from certain death on the junk-yard scrap heap and is joining fellow railroad enthusiasts of the Railroad and Locomotive Historical Society

in the task of rebuilding and refinishing the old camel-back engine for possible exhibition at the New York World's Fair in 1939. To the amazement of veteran railroad shop men, who thought that the railroad enthusiasts would soon tire of their self-appointed task, the amateur locomotive workers have put in close to 400 spare-time man-hours of labor on old 952 in the Kingsland, N.J., repair shops of the D.L. & W. Four of the enthusiastic amateurs are pictured at work below.

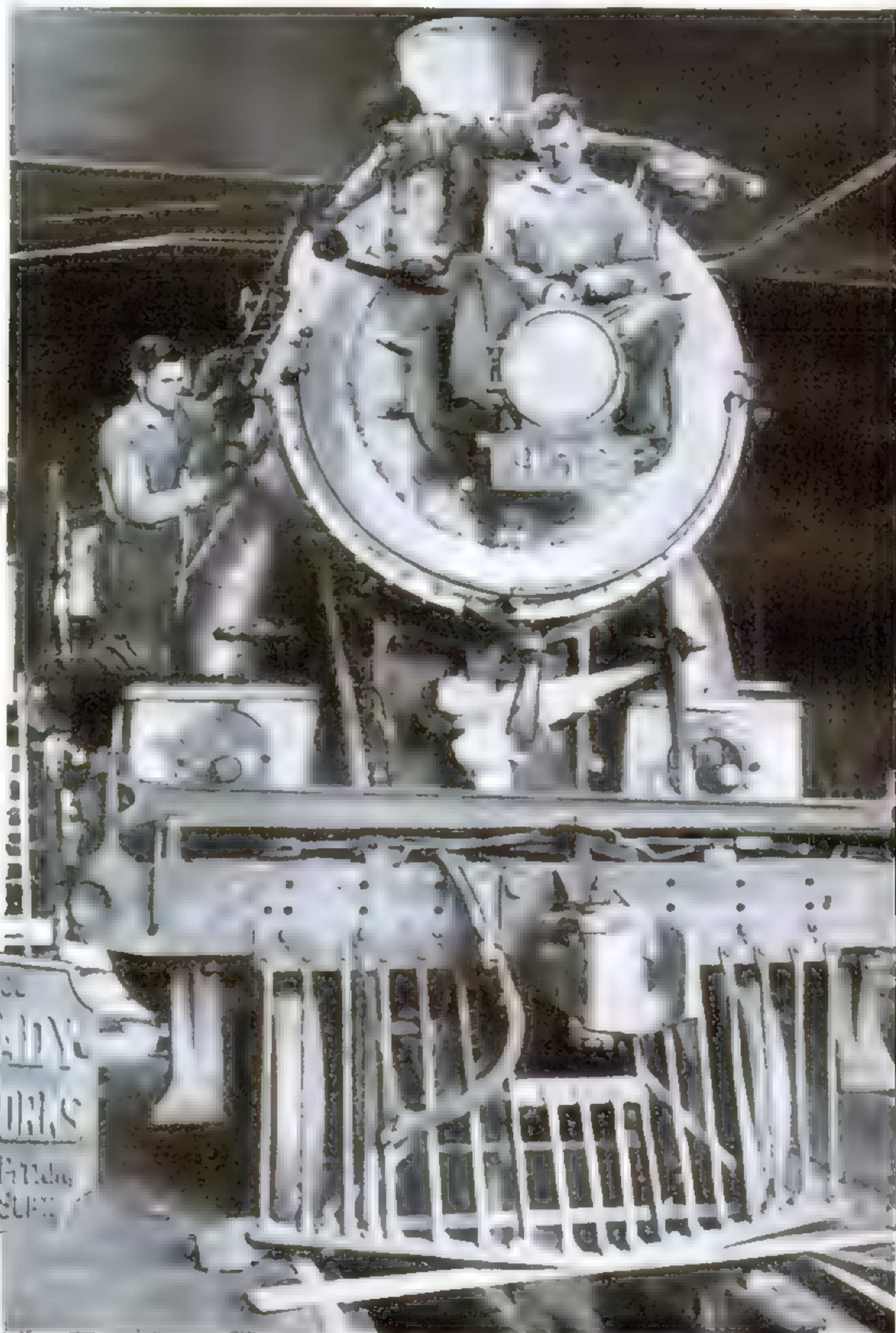


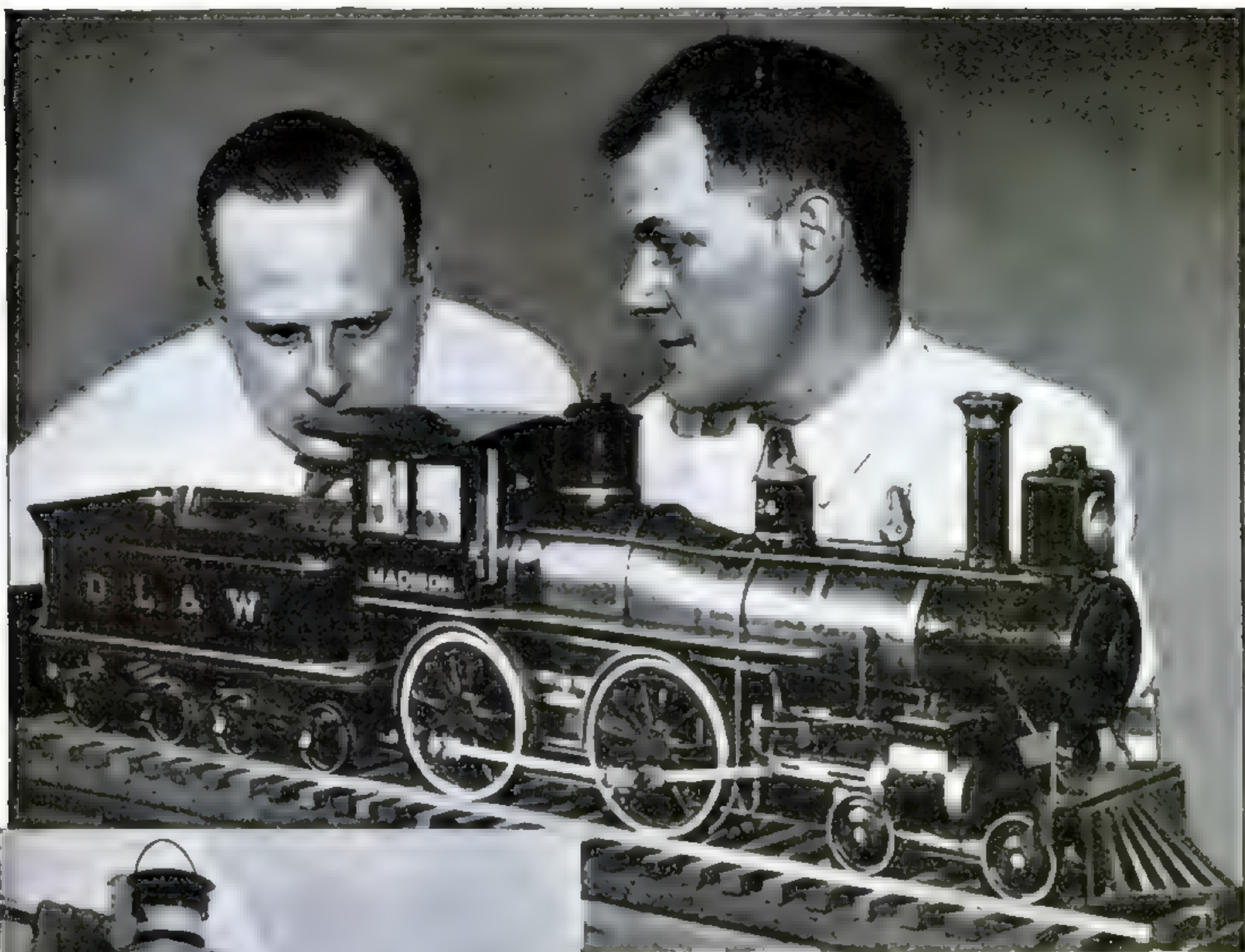
This old locomotive bell calls the Taber family in to dinner



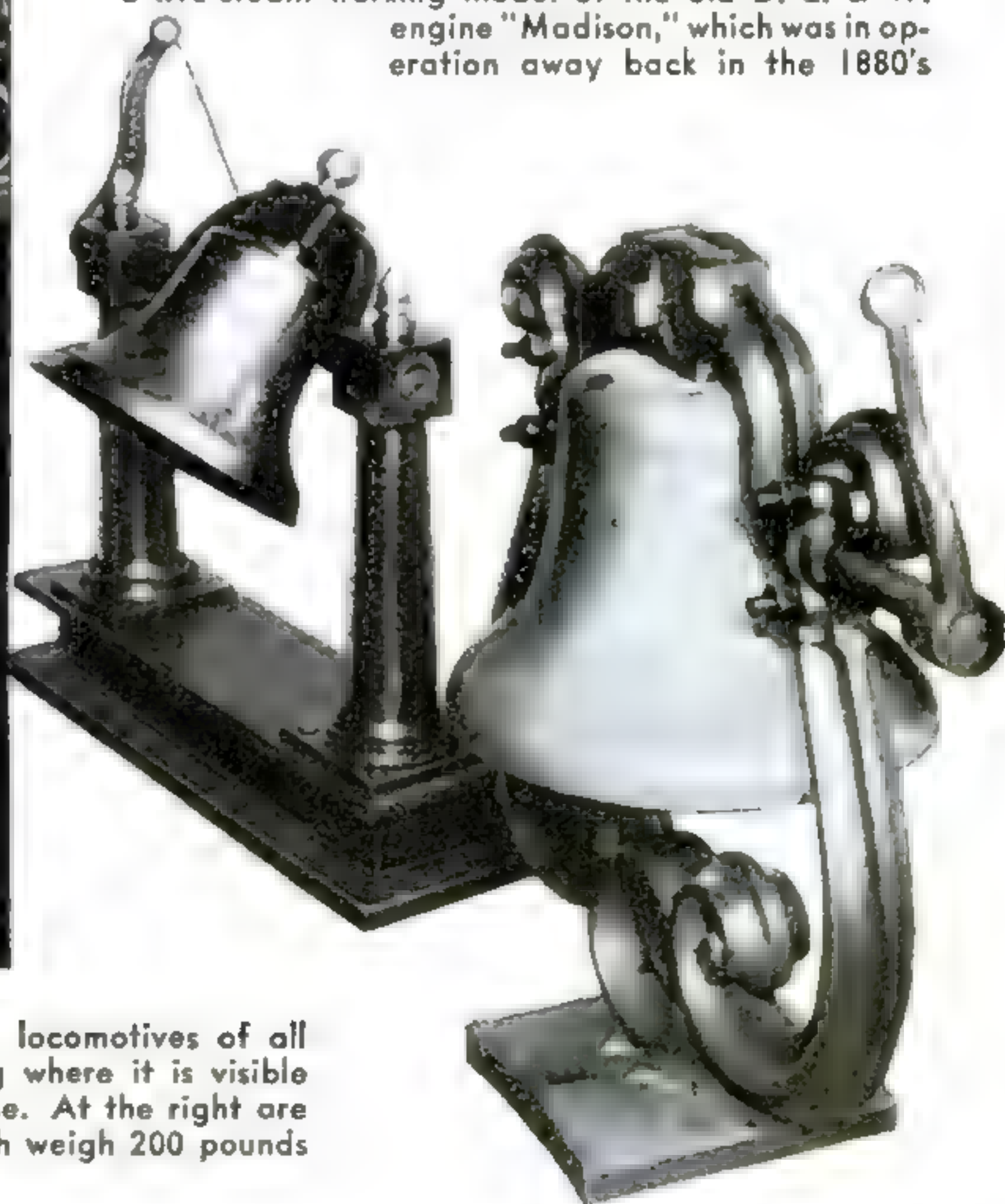
Walls of the unique museum are lined with locomotive-builders' name plates like these

Taber (astride the headlight) with other railroad fans overhauling an old locomotive at the Kingsland, N.J., shops of the Delaware, Lackawanna & Western



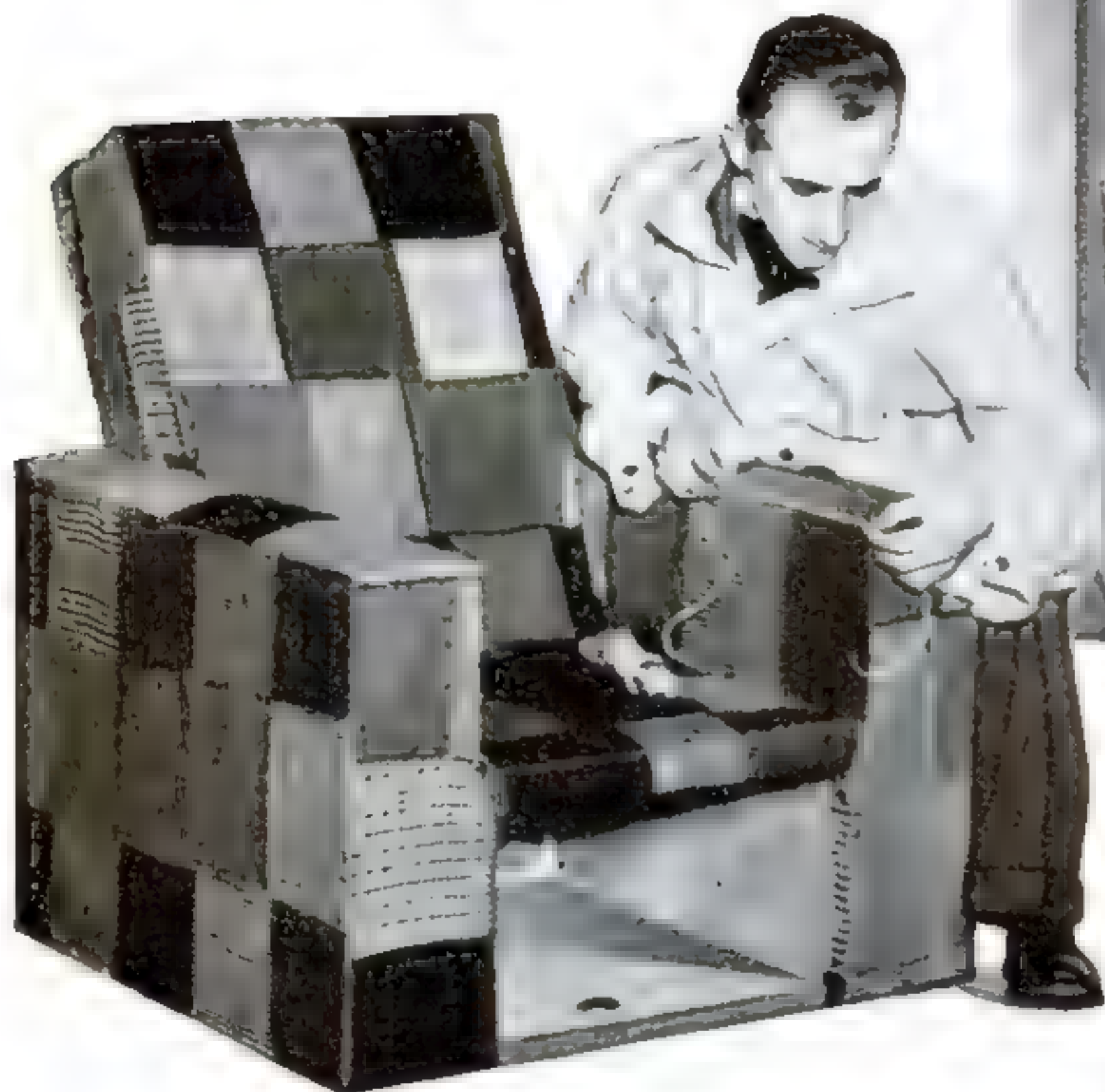


Taber shows a friend one of his prize possessions, a live-steam working model of the old D. L. & W. engine "Madison," which was in operation away back in the 1880's



Thousands of photographs in Taber's files show locomotives of all types and periods. Note the marker lamp hung where it is visible through the window from the outside of the house. At the right are two items in his collection of bells, some of which weigh 200 pounds

Attic Yields Materials for Chair and Piano



This chair is made of wooden crates, inner tubes, and scraps of cloth. At the upper right, the wineglass piano, which is tuned by putting water into the glasses



FROM odds and ends he found cluttering up his attic storage space, an ingenious Englishman constructed the novel musical instrument shown above and the upholstered chair pictured at the left. The pianolike instrument, called a "glass-a-tone," was made from bits of Venetian blinds, broken wineglasses, children's blocks, scrap timber, and some old tin cans. The chair has a packing-crate-wood frame and springs made from inflated tire tubes.

Moving Model of Coal Town Shows Miners at Work

ALL the life and activity of a coal-mining area is shown in motion by an amazing scale model constructed by Willard and Erle Beers of Scranton, Pa. Operated electrically, the mine model has more than 1,000

moving parts and more than 10,000 separate pieces. In action, it shows miners at work below ground, a cat-and-dog fight on a house porch, a mule being shod, moving freight and passenger trains, and other activities.



Erle Beers, of Scranton, Pa., with the model of a coal-mining town built by him and his brother, Willard



Streamline Design Gives Yacht Speed

SLICING its knifelike prow through the waters off the coast of Long Island, N.Y., the *Q.E.D.*, a streamline motor yacht of radical design, is now undergoing shakedown tests under the direction of its designer, Anthony H. G. Fokker, world-famous airplane designer. Shown in the photograph at the left tied up at a yacht-club dock at Montauk, Long Island, the speedy express cruiser is expected by its owner to revolutionize future designing of motor yachts by serving as an experimental example of what efficient streamlining and hull construction can do to cut down the resistance of air and water, and thereby increase boat speed without the necessity of any increase in the power rating of the engines.

Anthony H. G. Fokker aboard the new streamline yacht

Dog Clears Driftwood from Seaplane Base

RETRIEVING logs, spars, and other driftwood that might injure the pontoons of seaplanes taxiing into the seaplane base at the foot of Wall Street, New York City, is the task assigned to Tiger, the three-year-old dog shown at work in the photograph below. Day in and day out, Tiger, a German boxer, stands guard on the seaplane ramp, spots

driftwood floating in the East River, plunges into the water, swims out to the obstacle, and drags it to shore, no matter how large and bulky it may be. Owned by Carl Evers, a pilot who runs a charter seaplane service from the Wall Street base, Tiger was trained for his job by William Corcoran.



Tiger removes a long piece of driftwood from the plane basin



Camera crew preparing to film a steeplechase scene for a movie. A stand-in is taking the star's place on the mechanical horse while the cameras are being lined up and focused



Movie HOBBY HORSE

RUNS IN REAL RACE



BY ANIMATING a make-believe race horse with an electric motor, a clever mechanic of North Hollywood, Calif., solved a problem that had a movie director stumped. The director wanted to film a steeplechase scene showing the star close-up and the other riders in the background. What puzzled him was how the actor could keep near the camera and in focus at all times.

Pictures on these pages show how the race was successfully filmed. On outriggers attached to the camera car, the mechanic mounted the stuffed body of a real horse. Cams actuating its artificial legs gave it the mo-

All ready for the big race. An assistant director instructs the riders who will gallop in the background. The hero is mounted on his steed before the camera



They're off! The camera car runs along a road while the riders race beside it and the star bobs up and down in the foreground of the scene for a close-up. At the right is a near view of the stuffed horse and its clever mechanism

tion of a running steed. Power for the electric motor that operated it was supplied by a gas-driven generator at the front of the car, and among the parts of the odd contrivance were several motor-cycle sprockets, lengths of motor-cycle chain, and the connecting rods from an old gasoline engine.

Astride this strange hobby-horse, the star of the picture could be kept in perfect focus by the camera crew in the speeding car, as the vehicle raced along a country road with the rest of the riders in the background. Since only the top of the horse showed in the picture, the illusion of realism was complete.



Electric Secretary

**VERSATILE OFFICE MACHINE TAKES
DICTATION, RECORDS CONFERENCES,
AND EVEN ANSWERS THE TELEPHONE**

By ROBERT M. HYATT



This stenographer is typing a letter recorded upon a filmlike strip in the machine. She can use headphones or a loudspeaker, at will



Dictation is simple with the talking-letter unit. The small microphone is held in the hand as shown

SMALLER in size and approximately the same weight as a portable typewriter, an ingenious "electric secretary" developed by two Californians, W. E. Brainard and R. B. Walder, will

take dictation, answer the telephone and receive a caller's message, record conversations at conferences or over the phone, and perform countless other tasks, not only in offices but also in schoolrooms, homes, theaters, and other places.

Although complete details of the device have not been revealed, it is known that it employs a microphone to pick up sounds, which are automatically amplified and recorded by a stylus on a moving strip of filmlike material only three one-thousandths of an inch thick. The machine then plays the sound back, either through a set of headphones or through a built-in loudspeaker.

Known as voice loops, these film strips are not inflammable, can be played back 100 or



Here the electric secretary is sitting in at a conference. No matter how many persons are talking at once, the machine gets it all

Writes Talking Letters



A voice loop being placed in an envelope for mailing, to be reproduced on the recipient's machine. At right, the device records a telephone conversation on a call that came in while its owner was dictating

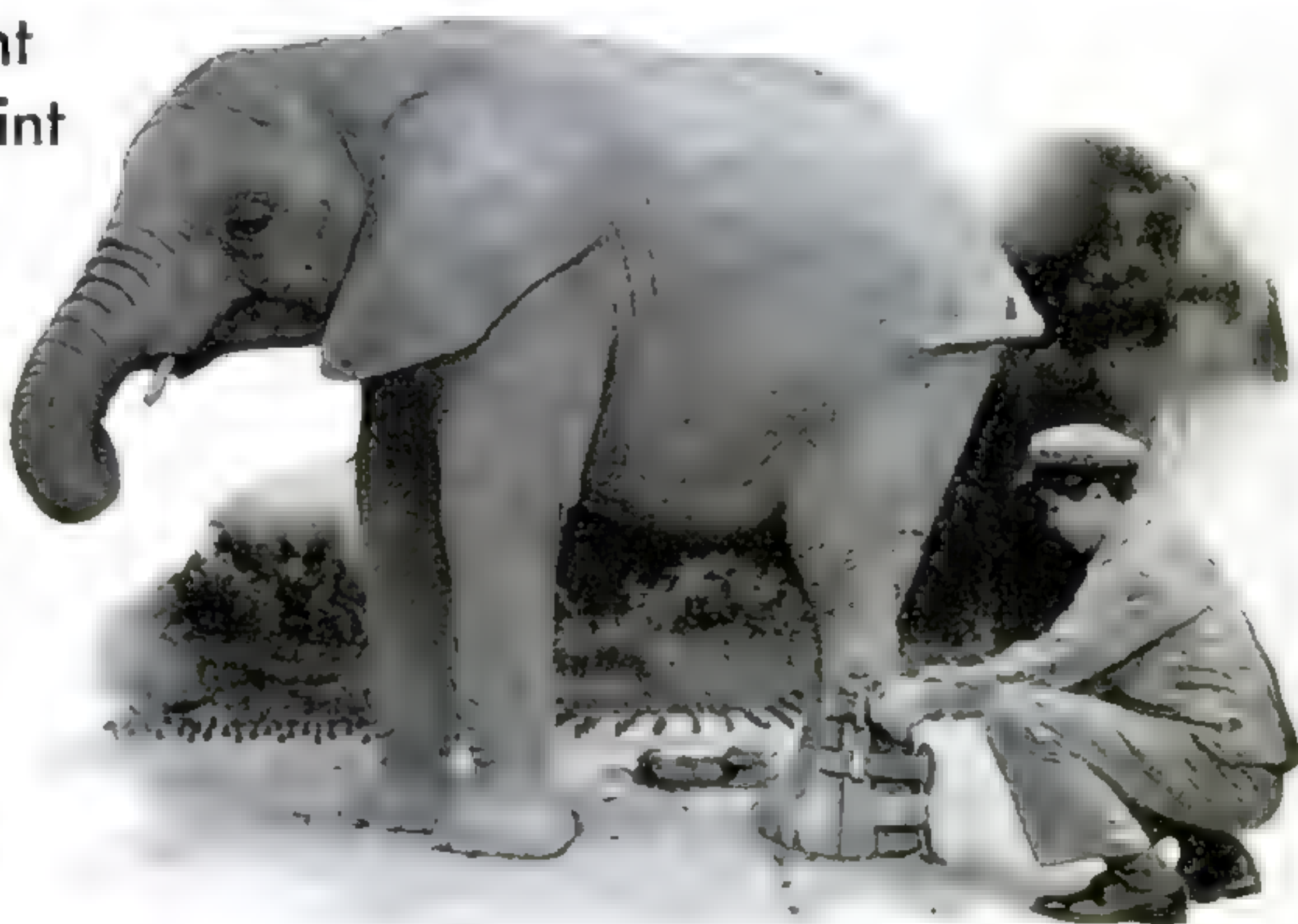
more times, and can be folded, creased, or wrinkled without affecting reproduction of messages. They are so light that three loops, each capable of holding ten standard-length business letters, can be mailed in an ordinary envelope for three cents. Thus the strips themselves, which cost about five cents, can be sent by mail to serve as talking letters, which can be played back by anyone having a

similar machine, and filed for future use.

By the use of a special attachment, the device will lift the telephone receiver when the owner is absent, and automatically answer a ring by speaking into the mouthpiece a recorded statement such as: "Mr. Jones is not in. But I'll be glad to take a message and give it to him later." The caller's message is then recorded in its entirety.

Injured Elephant Wears Leg Splint

WHEN a baby elephant in a French zoo sprained its ankle, its keeper devised a special splint out of leather straps and strips of wood which he fastened to the elephant's injured member. The makeshift brace, which served also as a shoe, prevented the animal's weight from aggravating the injury when it walked about. In the illustration at the right, an attendant is adjusting the straps that hold the splint in place.



War Canoe Carved with Primitive Tools



Andrew Joe, Swinohomish Indian, at work on a dugout canoe



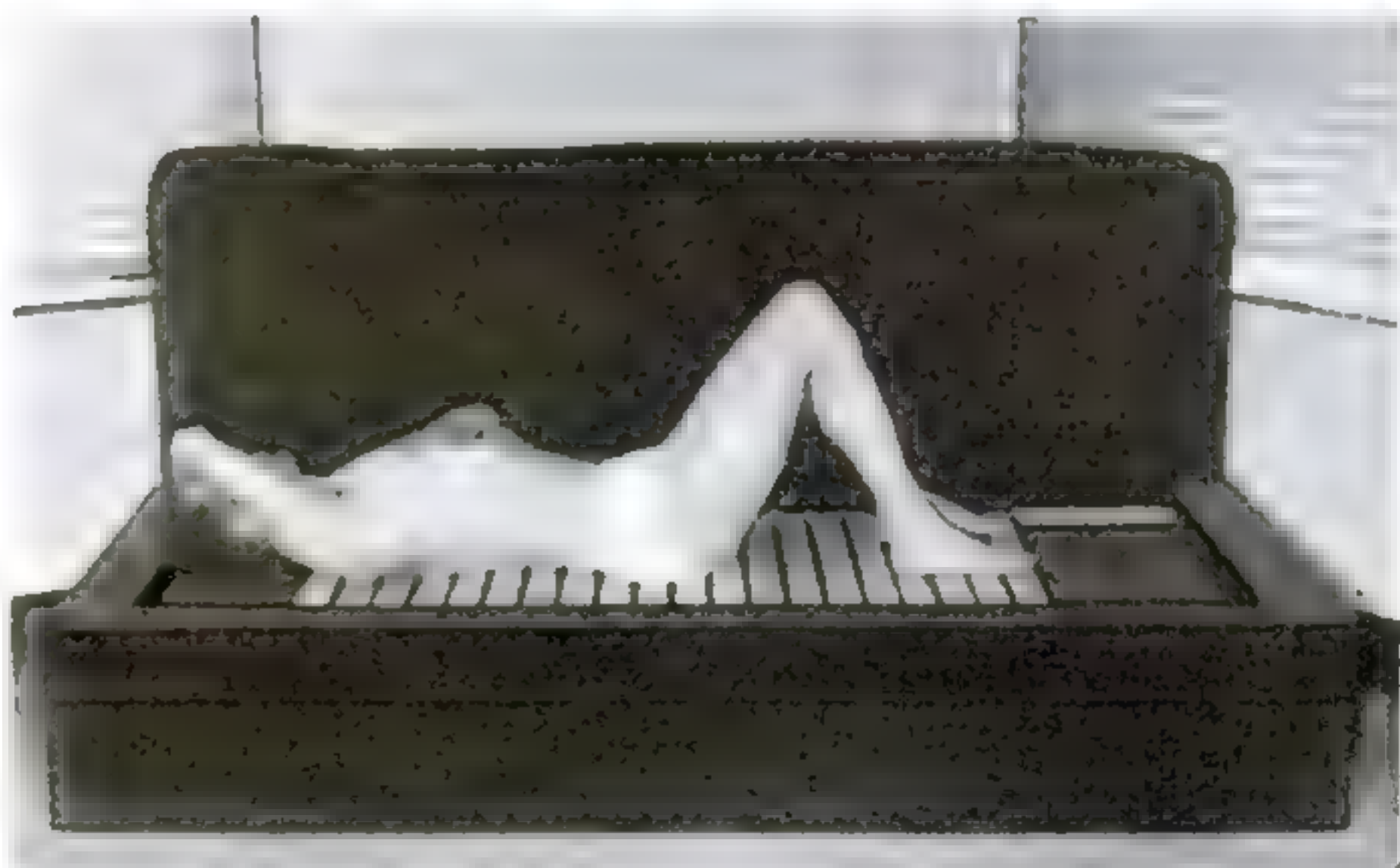
Light and graceful, this hand-carved craft was entered in a race between crews of Indians

WITH a skill handed down through generations of expert craftsmen, Andrew Joe, chief of the U.S. Indian Police on the Swinohomish Reservation,

carved out the speedy and graceful war canoe pictured in the photograph above for the use of his tribe's crew in a recent championship race between Indian tribes, held at Coupeville, Wash. Using only old-time and comparatively crude Indian-made tools, forty-five-year-old Joe spent eight months of careful, intensive work on the 250-pound craft, which has an exceptionally thin hull worked to a uniform thickness throughout. One of the twelve places in the canoe was reserved for Andrew Joe.

Exercising Machine Built into Couch

SERVING as a studio couch when not in operation, a novel exercise machine recently invented by E. H. Hyter of Oklahoma City, Okla., is designed to reduce overweight, exercise the muscles, and stimulate blood circulation. When the couch is opened, the user lies down on rubber-covered massaging straps that are shuttled back and forth by means of an electric motor. A mattress covers the straps when the unit is used as a couch.



The exercising couch in use. Slats shuttle sideways for a massage

Flames Test Fireproof Paint



This little house had no fireproofing treatment

FIFTY pounds of blazing excelsior failed to damage a miniature wooden house or its furnishings, in a spectacular demonstration of fireproofing materials. Its woodwork was protected by a fire-resisting paint developed for schools, theaters, and churches; while its window curtains and carpets were saved from damage by a chemical flameproofing treatment. A duplicate, untreated house, subjected to the same test, was destroyed.



This house was painted with fire-resisting paint



Blazing excelsior turned the untreated house into a flaming inferno within a short time ..



.. while the treated house, with its draperies and carpet, successfully resisted the flames



The end of the spectacular demonstration found nothing left of the unprotected building but embers



Witnesses inspecting the fireproofed house after the test. Terrific heat had melted the window glass

Marvelous Photos of



Seal-hunting with a camera. Here the giant instrument is mounted on the bow of a boat



A baby seal asleep on the beach, sprawled out like a human infant napping

C'mon over! One of the expedition members acting like a seal to lure the mammals up into range



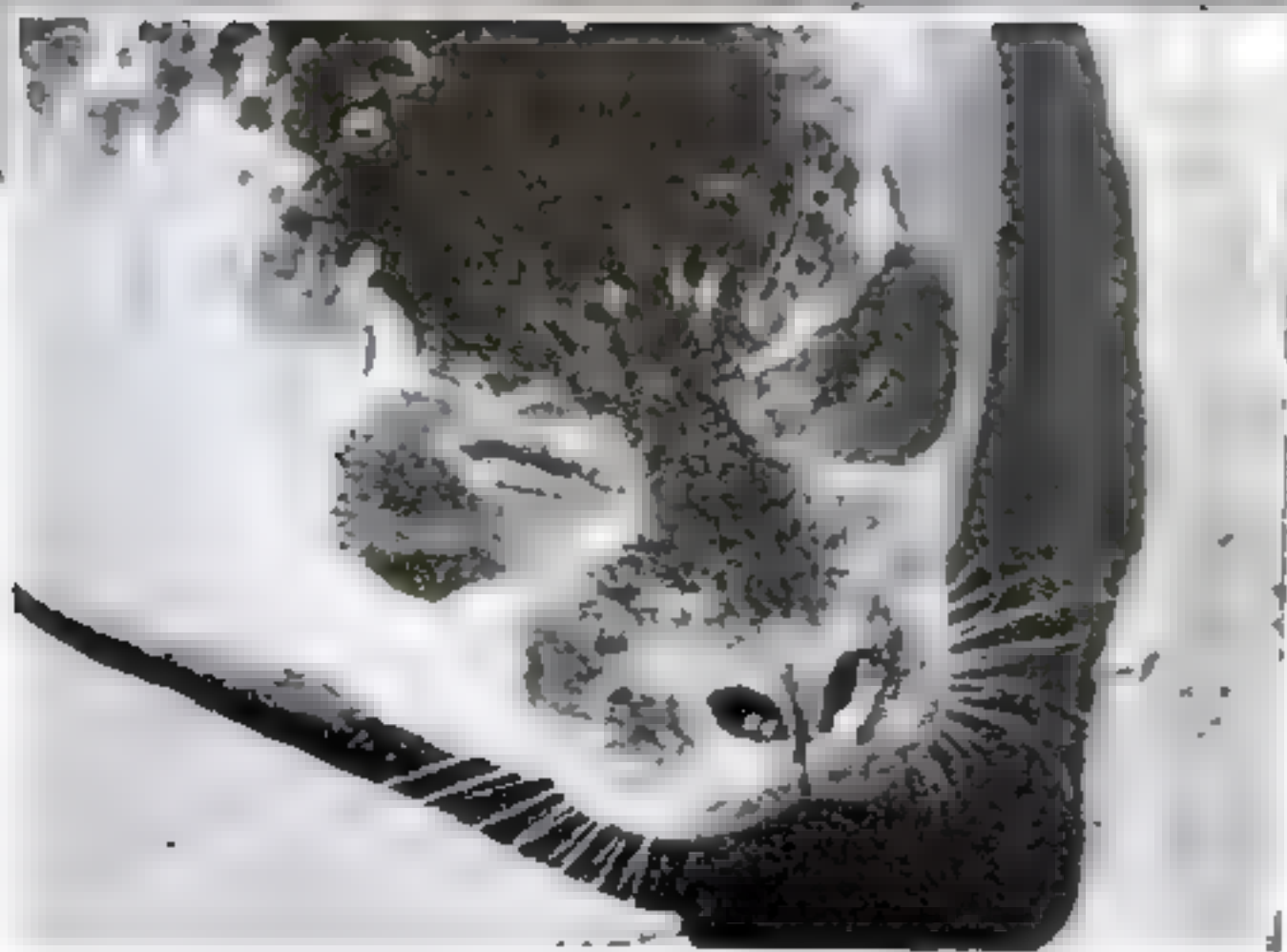
EMPLOYING a giant long-range telescopic camera, special mud sledges, and human decoys, a German expedition recently obtained a remarkable photographic record of the private life of seals in their wild state. After

making a preliminary census of seal population, expedition members first tried to film the timid animals by mounting their high-power camera on the foredeck of their supply ship, which they headed full-speed toward a seal bank in an attempt to obtain pictures before the mammals scampered off into the water. When this failed to give

Wild Seals

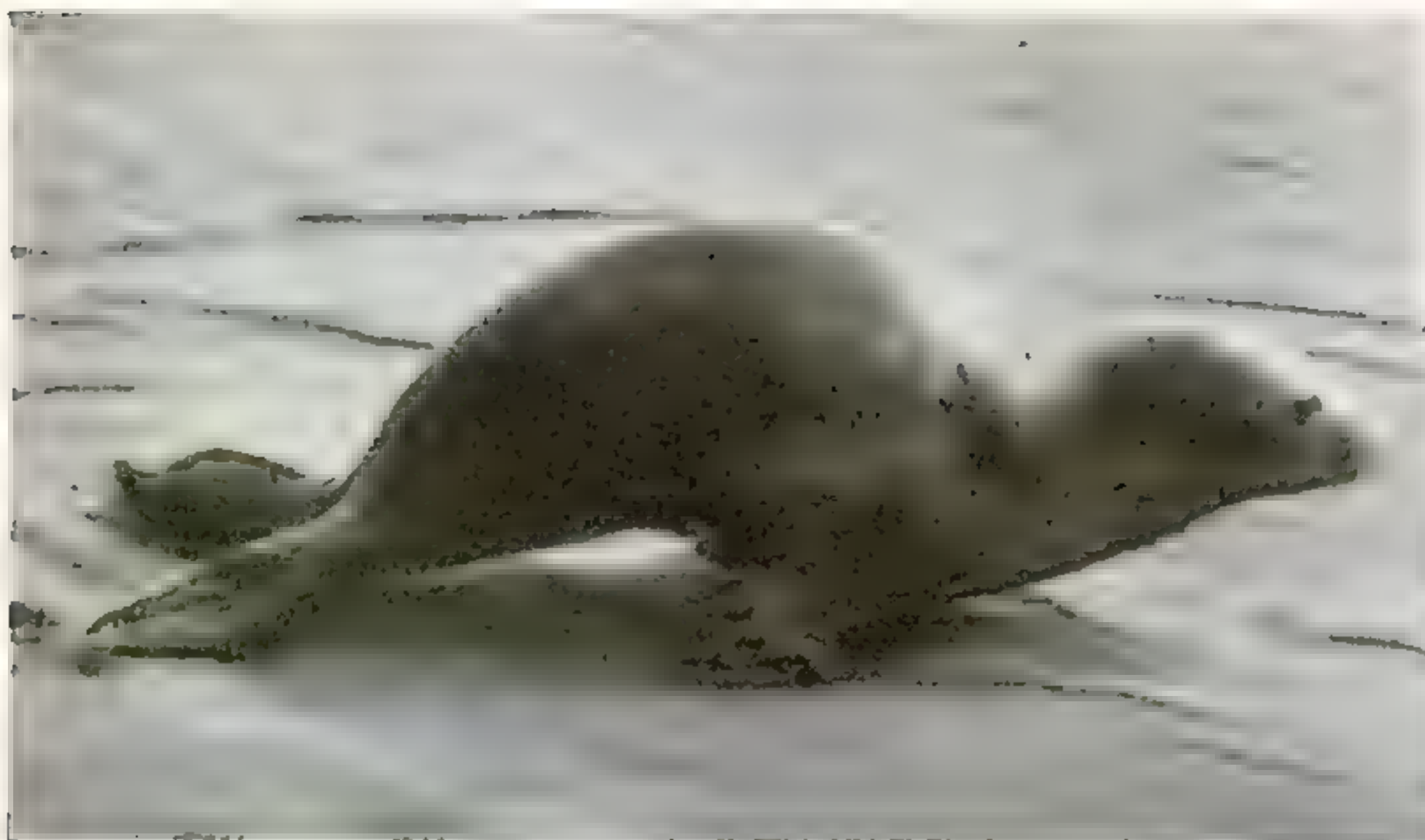
TAKEN WITH GIANT TELESCOPE CAMERA

Mother seal greeting her
young one after an escape
from the strange visitors



There's that man again! In this remarkable telescopic photograph, you can see the apprehensive look on the mother's face as she escorts her baby to safety

Long-range candid-camera shot of a gentleman seal enjoying his afternoon nap. It's getting so a seal has no more privacy than one of those movie stars!



Mistaking a human decoy for its mother, this young seal waddled in range of the well-hidden camera

Mud banks made dangerous going, as shown below



very satisfactory results, the camera hunters stalked the seals on the treacherous mud banks, where they were constantly faced with the danger of being dragged down into the slimy muck. Flat-bottomed sledges solved the problem of transporting men, supplies, and photographic equipment over the bogs. To coax seals within camera range, men flopped down on the mud banks and acted like seals, honking and barking to excite the animals' curiosity. Still photographs selected from some of the resulting moving-picture films are reproduced on these pages.



The camera set up in the water to film seal life



Sledges like this carried men and supplies across the treacherous bogs with safety



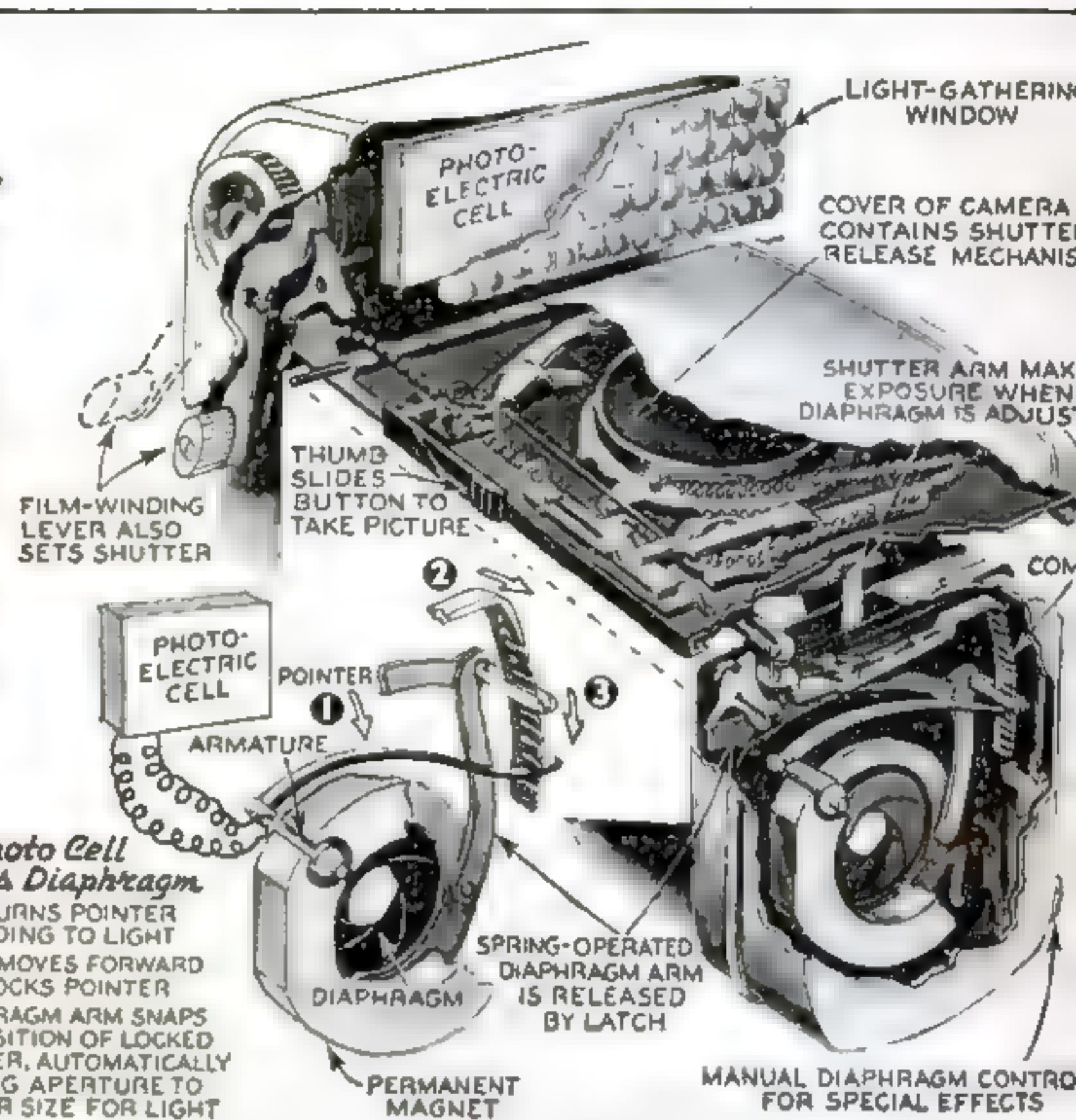
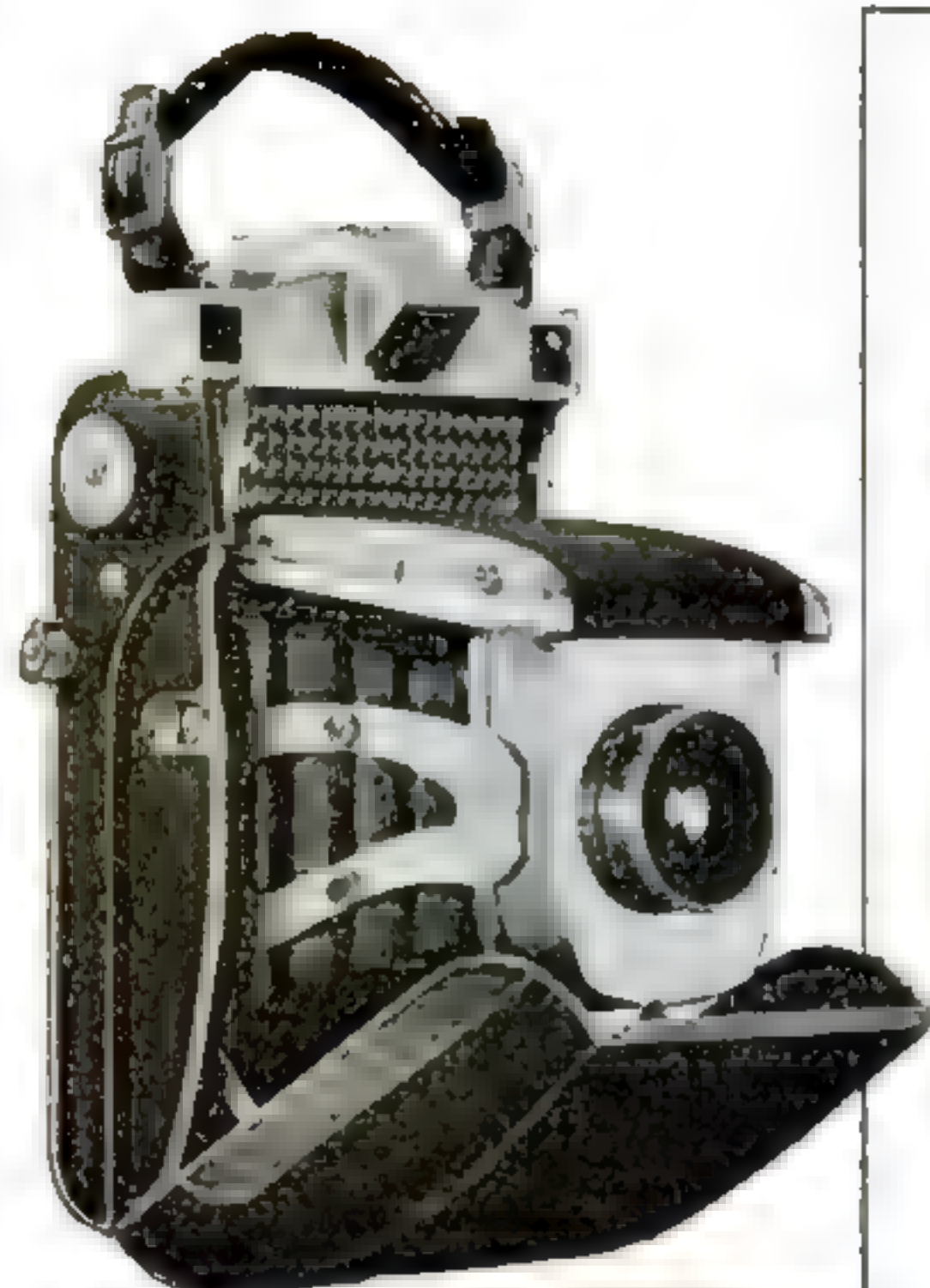
Camouflage: the camera crew digs in on a sandbank to lie in wait for its timid quarry



But, Mamma, what big flippers you have! This baby seal was completely taken in by the decoy

Electric Eye Sets Camera

TWO PAGES OF THE LATEST DEVELOPMENTS



How Photo Cell Adjusts Diaphragm

- ① CELL TURNS POINTER ACCORDING TO LIGHT
- ② COMB MOVES FORWARD AND LOCKS POINTER
- ③ DIAPHRAGM ARM SNAPS TO POSITION OF LOCKED POINTER, AUTOMATICALLY CLOSING APERTURE TO PROPER SIZE FOR LIGHT



phragm arm which snaps down upon it, closing the lens diaphragm from its full aperture of F/3.5 to the proper size just before the shutter clicks. Interlocking levers time these actions in just the right split-second sequence.

Additional refinements include a range finder coupled to the focusing mount of the lens, a film-winding lever interconnected with the shutter to make double exposures impossible, and a built-in "self-timer" for delayed exposures. The camera makes eight pictures of $2\frac{1}{4} \times 3\frac{1}{4}$ -inch size on a roll of film, and despite its elaborate mechanism folds as compactly as a conventional model.

PROVIDED with a built-in photo-electric cell, a remarkable new pocket camera for amateurs adjusts itself to suit the light. When the user operates a triggerlike thumb button, the lens automatically "stops down" for a perfect exposure at the selected shutter speed, and the shutter then takes the picture.

Within the camera, a slender pointer actuated by the "electric eye" moves downward with increasing light intensity. Locked at the moment of exposure, the pointer forms a stop for a spring-operated dia-

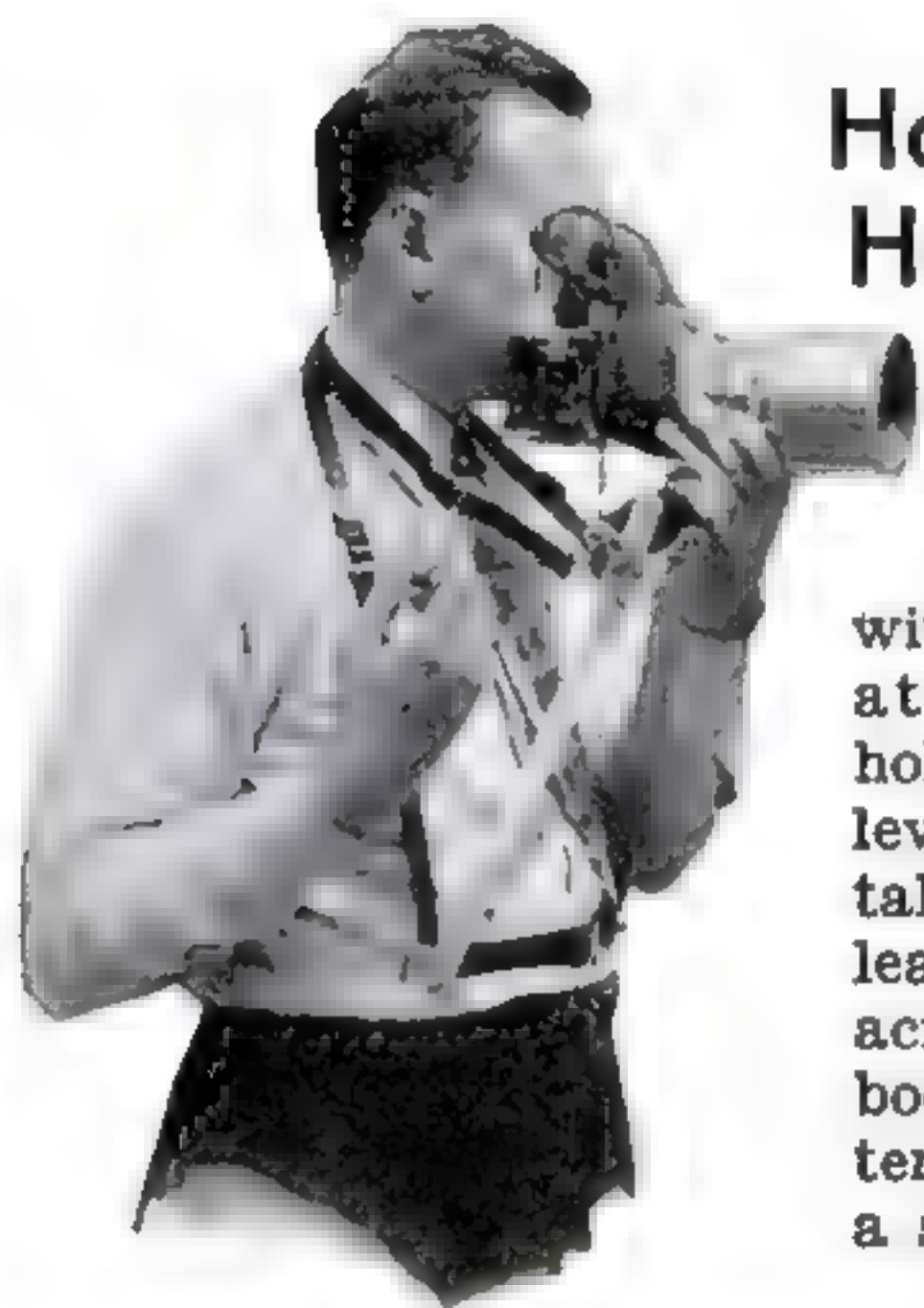
Control Box Times Prints

ATACHED to a printer or enlarger, a new time-control box automatically turns the light on and off. Settings provide accurate exposures of from one-half to eighty seconds. Electrically operated, the timer has no motor or clockwork.



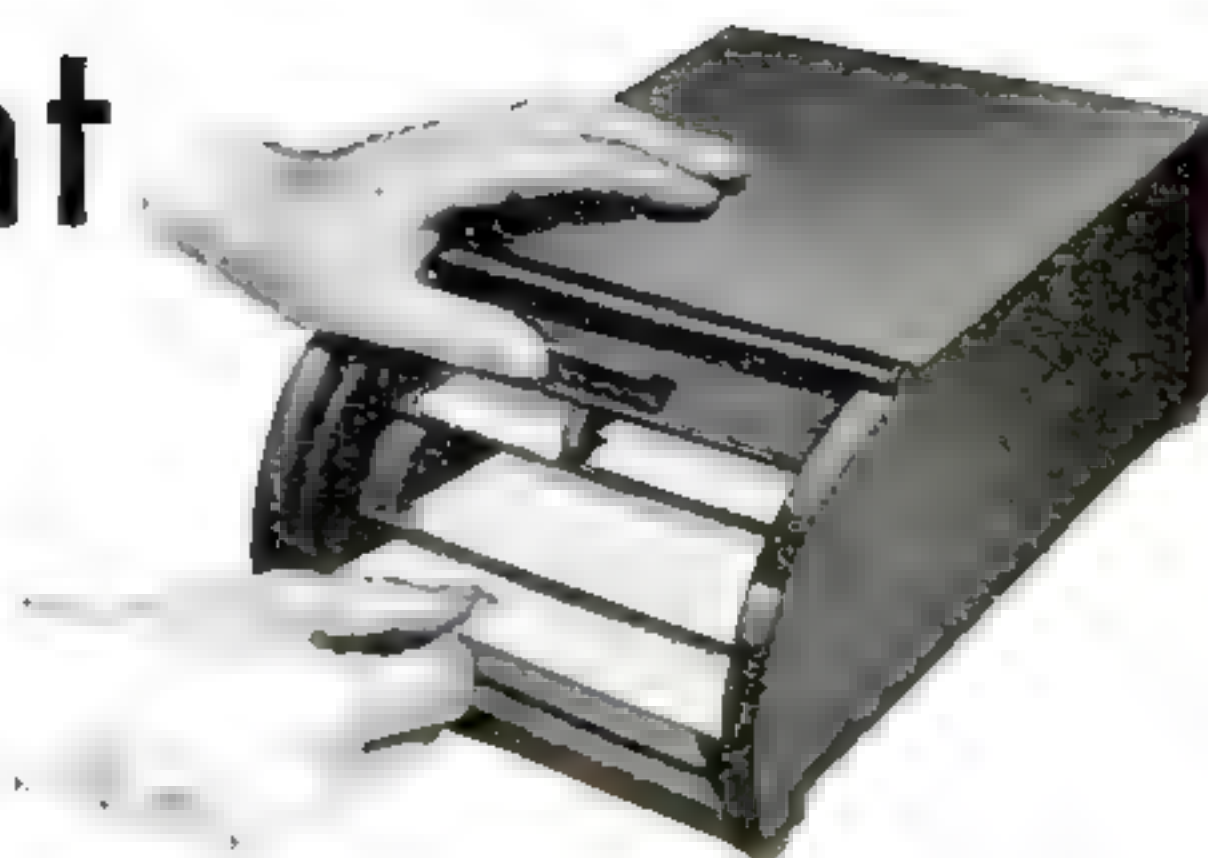
To Suit the Light

IN AMATEUR PHOTOGRAPHY



Harness Supports Heavy Miniature

TO EASE the burden of the enthusiast whose miniature camera is weighted down with heavy lenses and other attachments, a harness holds the instrument at eye level for prolonged picture-taking. It consists of a leather neck strap, a brace across the middle of the body, and metal arms extending from the brace to a swivel on the camera.



Handy Lightproof Box for Enlarging Paper

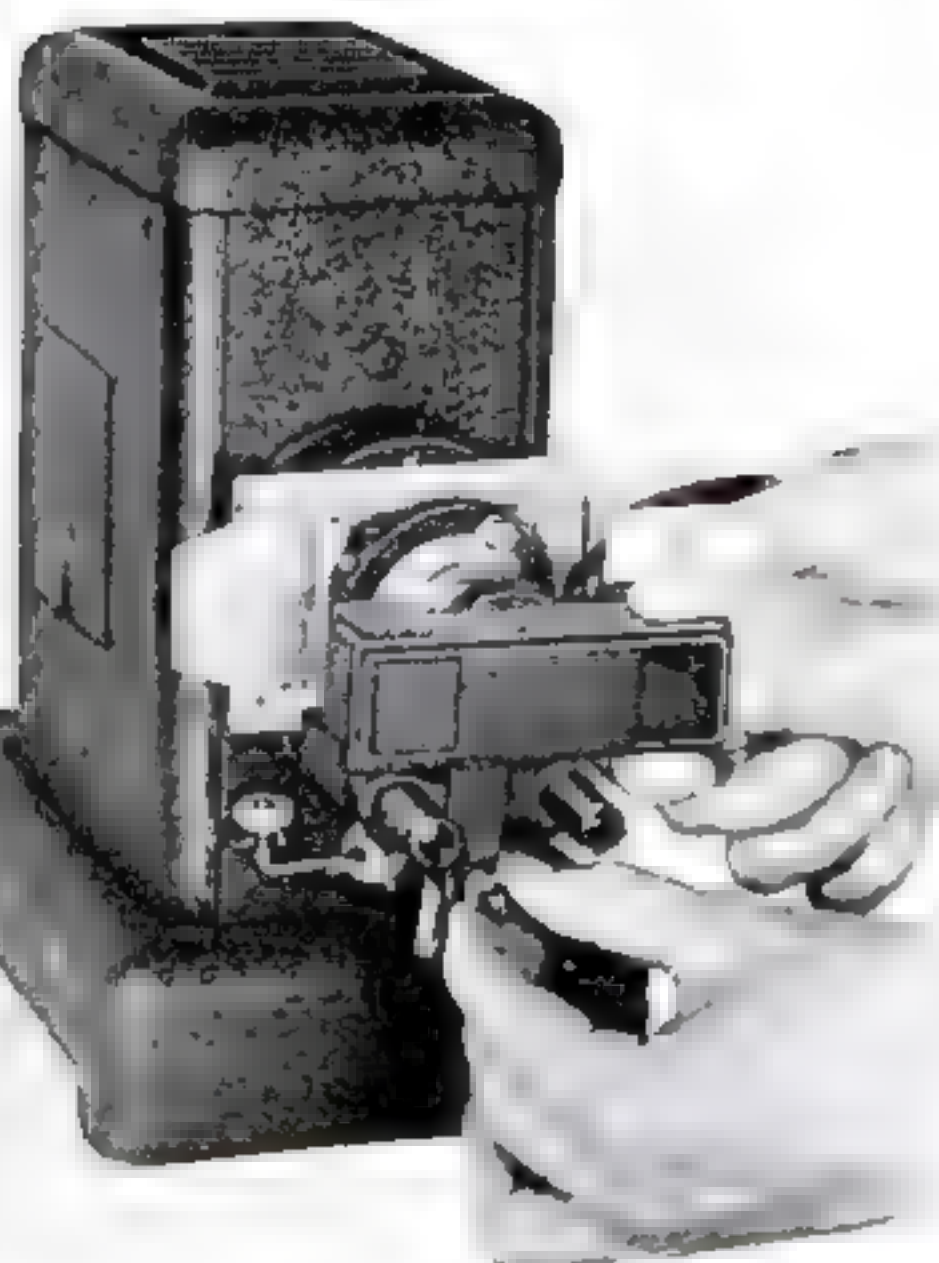
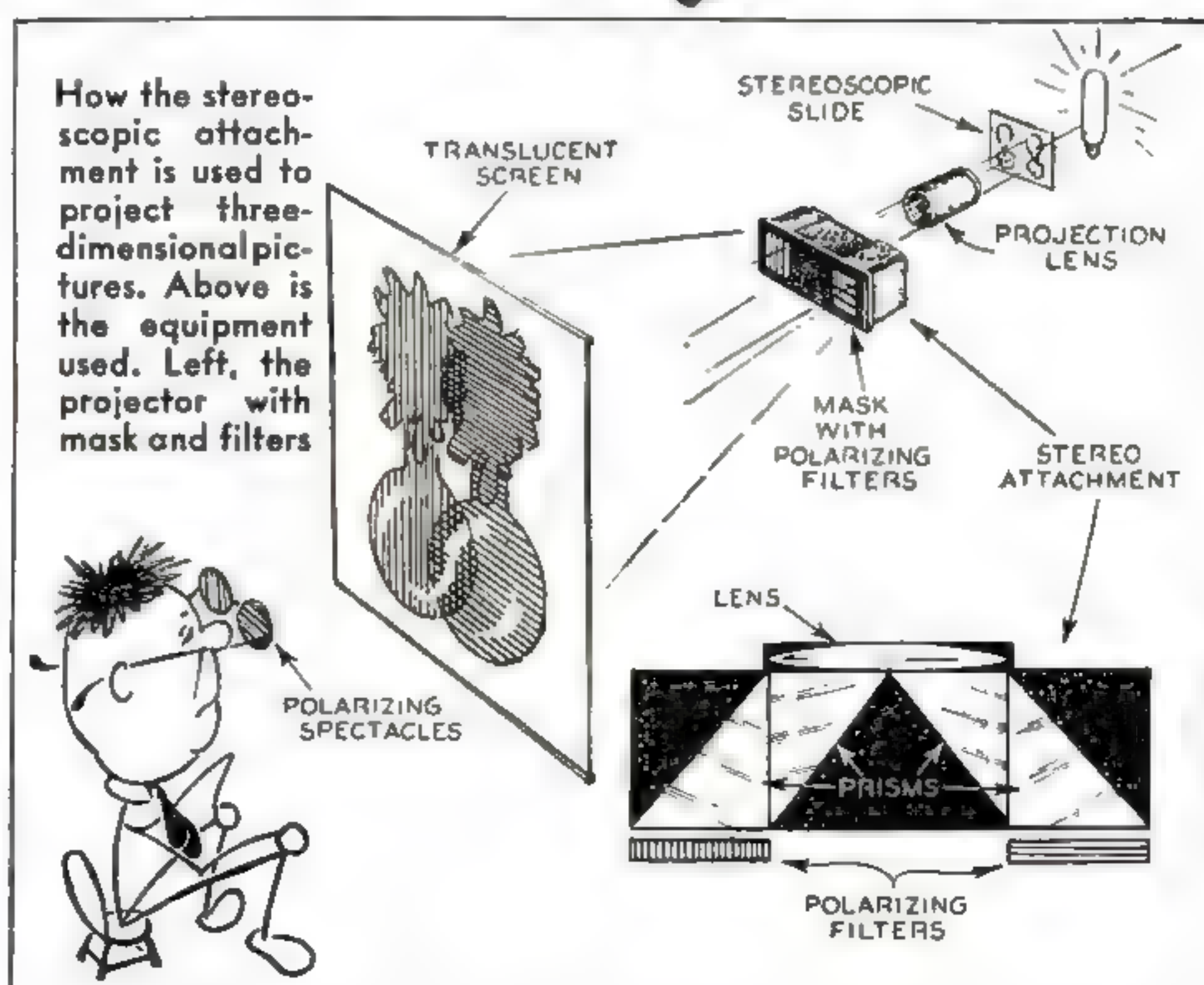
LIGHT-TIGHT and handy to use, a new roll-top box keeps enlarging paper within easy reach. A push of the thumb opens the rolling cover, which automatically springs shut when released, so that the box cannot be left open accidentally. Shelves are provided for three grades of paper.

Stereo Pictures Projected with Camera Attachment

ADAPTED for projecting as well as for taking three-dimensional pictures, a "stereo attachment" for a popular make of miniature camera has double usefulness. In taking the picture, the attachment is slipped over the camera lens, and the camera then makes twin views on a single negative. In projecting the photographs, the stereo attachment, fitted with a supplementary mask holding a pair of polarizing filters, is mounted on the projector, as shown in the photograph, to throw slides made from stereo negatives upon a translucent screen. An observer wearing spectacles of the same polarizing material sees three-dimensional pictures.



How the stereoscopic attachment is used to project three-dimensional pictures. Above is the equipment used. Left, the projector with mask and filters



Historic



Sailing ship ahoy! The first ship of the fleet, a topsail schooner, as she will appear when finally completed. Old plans served as the basis for her design

**Famous Ships of the Past
Will Sail the Seas Again
in Accurate Reproductions
Built from Old Plans and
Fitted with Every Luxury
for Cruising in Any Clime**

**By
KENNETH M. SWEZEY**

BUILT on the lines of the famous "Baltimore clippers" that made history during the American Revolution and the War of 1812, one of the most novel and individual sailing ships afloat is now being sparred and rigged in an Ipswich, Mass., shipyard. Unlike restorations or copies of other famed ships, however, this seventy-foot topsail schooner—the first of its type to be built in eighty years—is no museum piece or antiquarian's dream. It is laid out as a modern yacht for world cruising, harking back in its design to the most romantic days of American seafaring purely for the speed, comfort, and character for which the Baltimore clipper was noted.

Yet here the story just begins. *Schooner No. 1*, as the vessel is designated during construction, is merely the *first* in a long line of pilot boats, topsail schooners, brigantines, brigs, and possibly full-rigged ships, that are to be built in succession in a thrilling venture that

'Clippers' NOW MODELS FOR MODERN YACHTS

aims to bring back imagination and romance to sailing-ship design. In these vessels, modern standards of comfort and luxury will be combined with the finest hulls and rigs developed during two centuries of American shipbuilding.

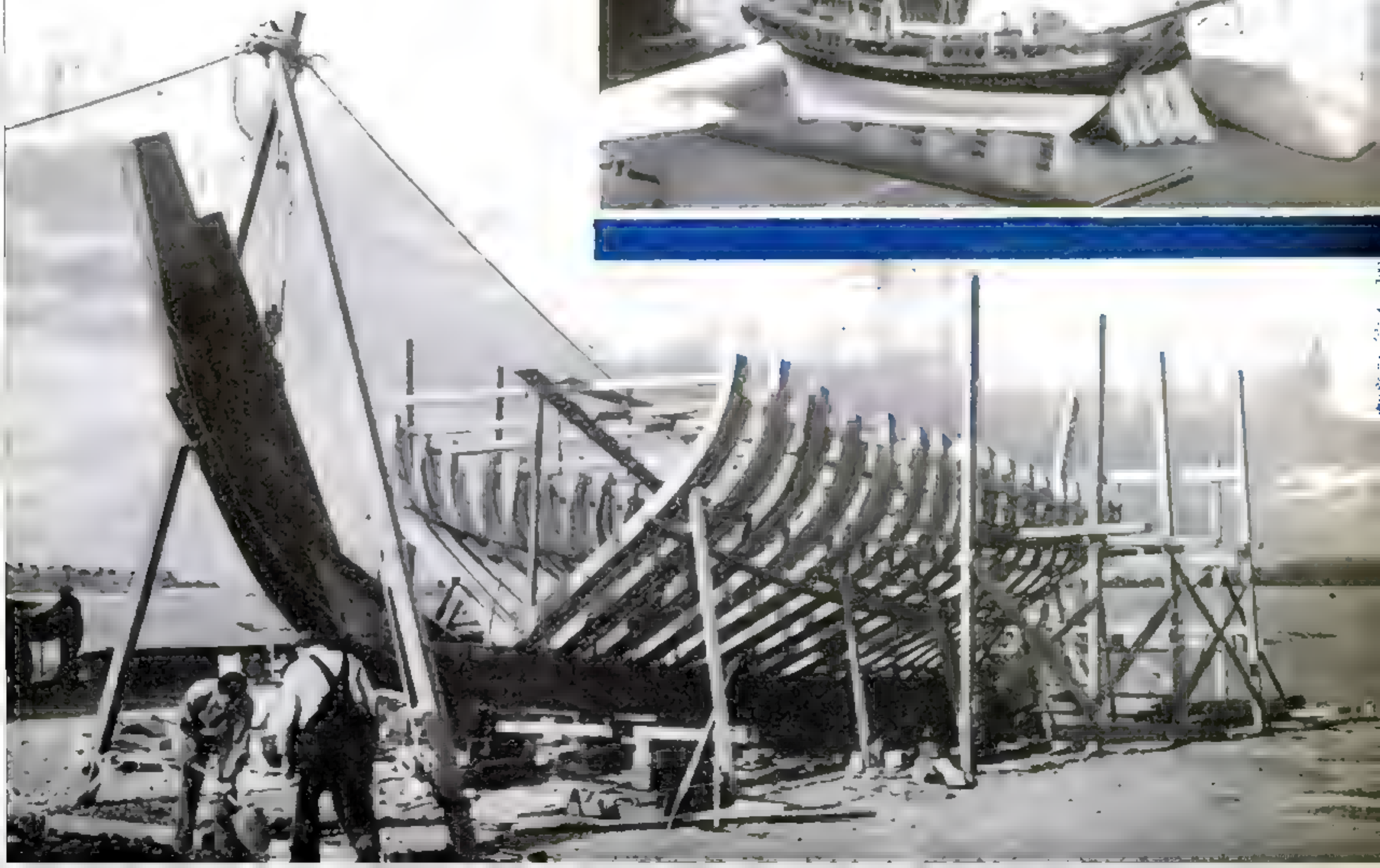
Behind this amazing project are a world voyager, a noted naval architect and authority on sailing ships, and a crew of experienced shipwrights and ship-smiths from Essex and Ipswich yards, where skill and tradition go back in an unbroken line to the days of Colonial America. William Albert Robinson, author of "Ten Thousand Leagues over the Sea," an account of his cruise around the world in the thirty-two-foot, ketch-rigged *Svaap*, is one of the partner builders; Howard I. Chapelle, yacht designer, and author of the "History of American Sailing Ships," is the other. Together, they are building ships on contract for yachtsmen who want to get away from modern standardization.

Although *Schooner No. 1* is not an exact duplicate of any particular vessel, she is based largely upon the brigantine *Swift*, of the Baltimore-clipper type, built about 1778 as an American privateer, and later captured by the British. Like many another fine American ship, the *Swift* was sailed to England, where

Howard I. Chapelle (left) and William Albert Robinson inspect model of the brigantine, "Swift," pattern for the new schooner



Skeletonlike timbers of the 1938-model "clipper" take form in an Ipswich, Mass., shipyard



Expert craftsmen had to be found who could do the unfamiliar work of wooden shipbuilding. Here William Walters, retired shipsmith who had become a blacksmith, is shown forging a heavy iron ring for one of the spars



Below, Walters tempers a special hammer. Because of the unique work, craftsmen had to fashion many special tools by hand



her design was carefully measured and drawn. This was fortunate for the present builders, for the only accurate plans in existence of this and many such noted American ships are now found in the archives of the British Admiralty!

The exact origin of the Baltimore clipper is obscure. Its development probably began in the shipyards of Virginia and Maryland in the early part of the Eighteenth Century. By the time of the Revolutionary War, however, and for more than sixty years after, these fast, "rakish top-sail schooners," brigs, and brigantines were making history in every maritime enterprise that required seaworthiness and speed.

First used as pilot boats and coastwise traders, they soon became invaluable for smuggling precious cargoes, and for blockade running in the face of powerful but more sluggish men-of-war. Later, their swiftness turned them to use as revenue cutters, slavers, pirates, and privateers. The *Ann McKim*, built at Baltimore in 1832 as the first of the great clipper ships that were soon after to command the trade of the

Planking applied, the hull looks old-fashioned, but within are modern bathrooms, staterooms, and luxurious appointments



world, was an enlarged and modified version of the earlier Baltimore-type clipper.

According to the designers of *Schooner No. 1*, this intensive evolution developed a type of hull and rig that could be ideally adapted for a modern yacht that would be at once fast, "sea-kindly," and suited for long cruises. The rig has been kept so simple that it can be handled easily by three men under all conditions of weather. Because of her design, the ship gives nearly twice as much usable space on and below deck as is found on the average modern yacht of the same length.

Recruiting the men who today could build an eighteenth-century ship was no easy task. Great ribs of yellow-pine heart had to be sawed and bent. Instead of nails



Hand-carved specially for the ship, this wooden figurehead will adorn the prow after the ancient custom on sailing vessels



or rivets, the vessel was to be fastened together with treenails, dowels made of locust wood that had been seasoned for twenty years. Huge straps, hooks, bolts, and rigging gear had to be hand-forged from Norway iron. A figurehead had to be carved, and a design of oak leaves and acorns carved in the teak trail boards.

When wooden shipbuilding slackened, men who had spent their lives at it had turned to cabinetmaking and house carpentry. These had to be sought out. An expert shipsmith, William Walters, was discovered in Gloucester, Mass., shoeing horses and fashioning ornamental ironwork. A young sculptor from West Gloucester was found who could do the carving.

One of the most delightful features of the ship is a "great cabin" aft, right under the quarter-deck, where one may lounge and look out windows that open astern, on each side, and over the spacious deck forward. Below this, bulkheaded and insulated completely from the rest of the ship, is a modern Diesel auxiliary engine of 110 horsepower that will give the vessel eight or nine knots when there is no wind, or in close quarters. Adding modern comfort to old individuality, the ship boasts two modern bathrooms, with tubs and all other facilities, and luxurious beds that stay on an even keel when the ship rolls.



Charles Henry Wood demonstrating his new electrical treatment for paralysis

New Electrical Treatment for Paralysis

SAID to be valuable in the treatment of infantile paralysis, an electrical device invented by Charles Henry Wood, California chiropractor, employs a type of current that is reputed to have an electrochemical effect on paralyzed parts of the human body. The apparatus is claimed to have a regenerating effect on the nerves of patients suffering from paralysis, restoring normal conditions. In the photograph at the left, Wood is demonstrating the treatment of the knee of a patient. The control box used in the operation of the instrument is on the table at the right.

Stamp Collector Makes Rare Find

WHILE sorting and rearranging a batch of newly purchased postage stamps, Warren R. Du Bois, Los Angeles, Calif., philatelist, discovered a one-cent blue United States stamp issued in 1861, mounted it in an album along with other items, and marked it for sale at three dollars. Two months later, while reexamining the stamp after prospective buyers had thumbed the album without showing any interest in this particular item, Du Bois found that it bore what is believed to be the earliest cancellation date marked on any stamp of this Civil War issue. This discovery immediately boosted the price of the stamp to a figure many times the value the owner had placed upon it at first, as early cancellations of this issue are eagerly sought by collectors.



The cancellation date marked on this stamp gives it great value

The truck's own engine runs this self-loading attachment



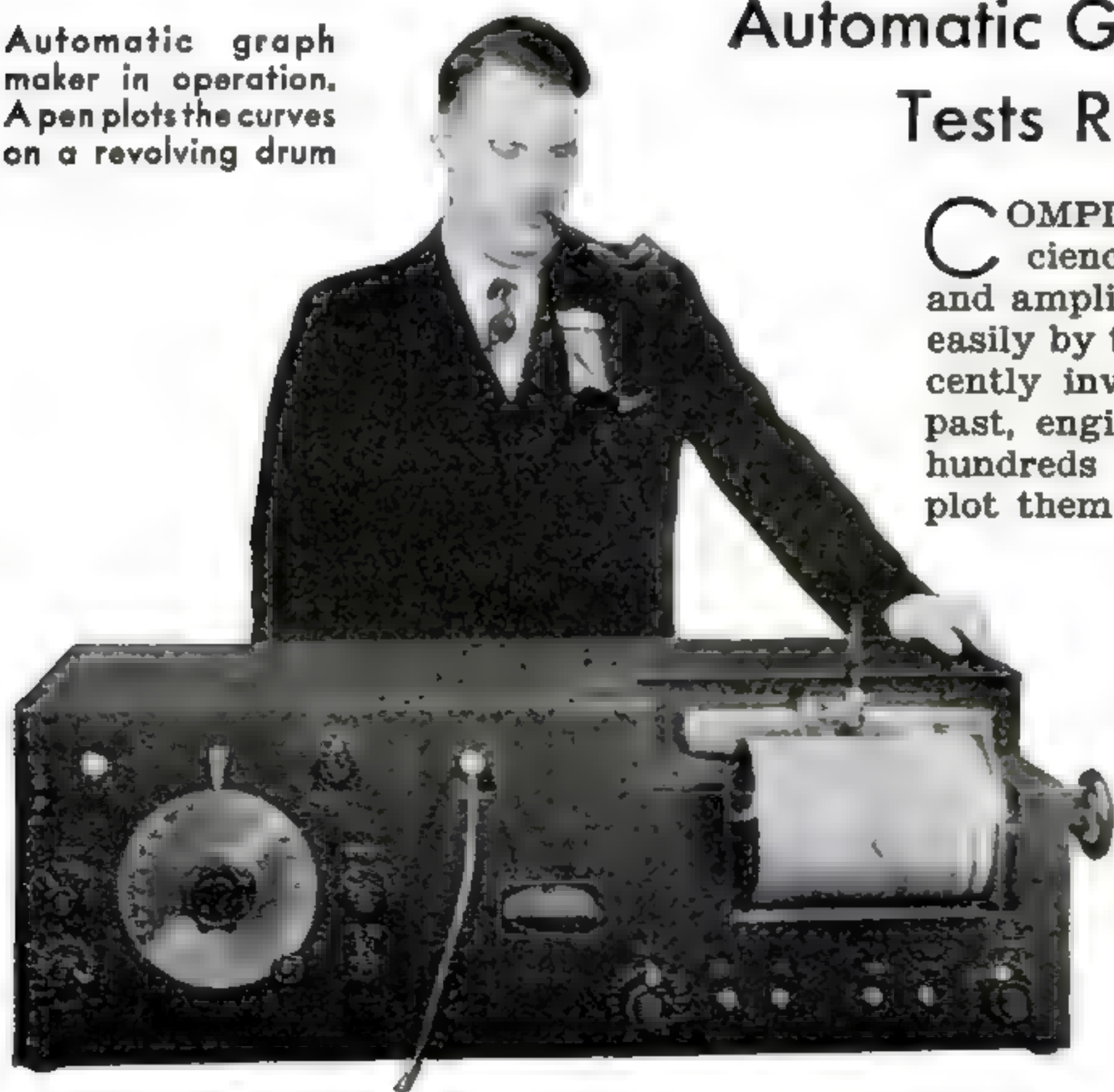
Truck Loads Itself Like a Steam Shovel

AN INGENUOUS apparatus invented by Dr. J. E. Owen of Asheville, N.C., enables a truck to load itself with the power of its own engine. A pivoted scoop hinged to a framework on the front of the truck scoops up dirt, sand, gravel, or other material as the truck moves forward. Wires running from the scoop over pulleys to a power take-off shaft bolted to the transmission hoist the scoop up over the cab to dump the contents into the truck body. This operation is controlled by the clutch of the truck, the gears being in neutral. The scoop loader is said to fill a truck faster than a steam shovel could accomplish the same task.



Scoop rises over cab to dump load in truck body

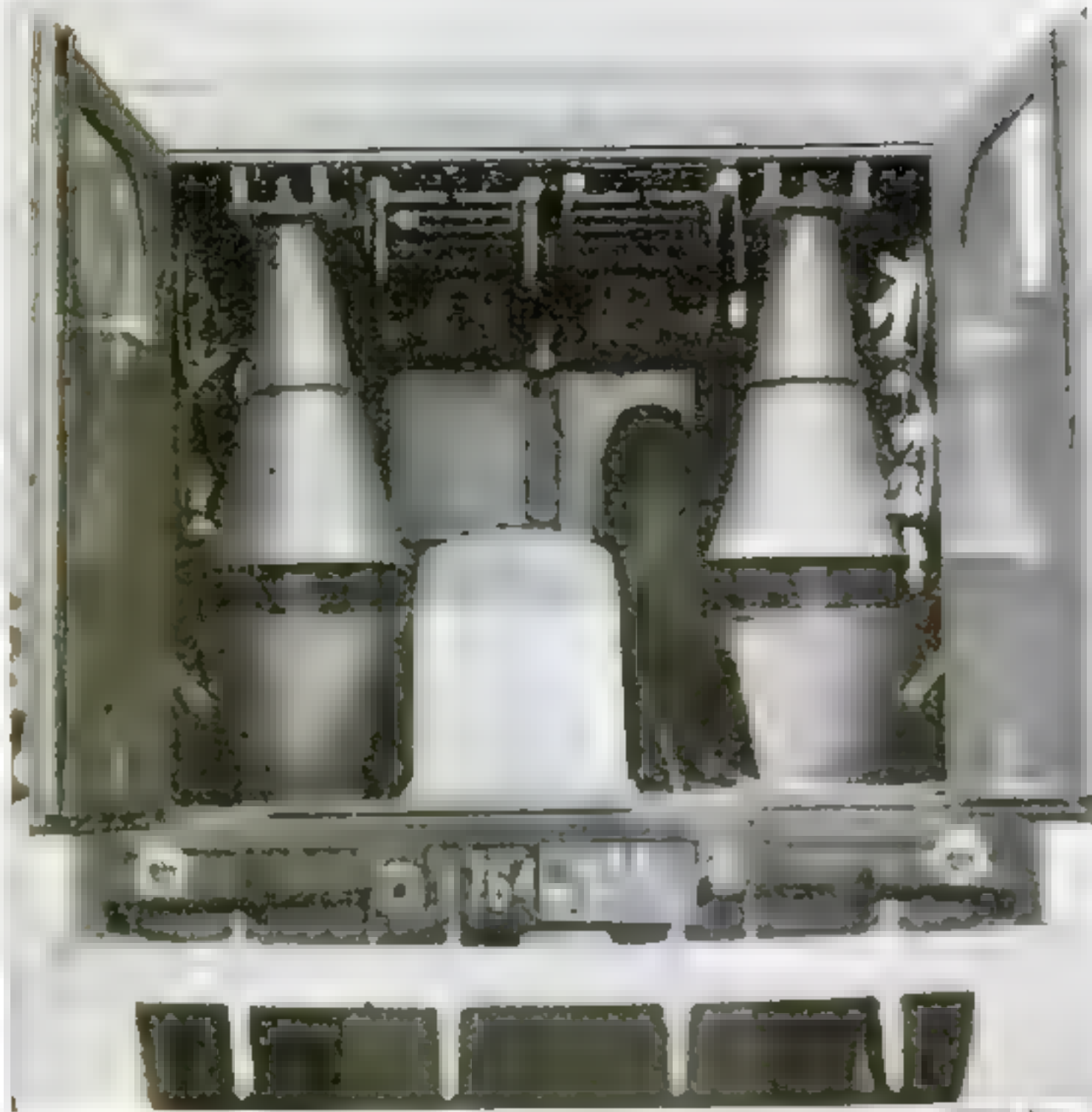
Automatic graph maker in operation. A pen plots the curves on a revolving drum



Automatic Graph-Drawing Device Tests Radio Instruments

COMPLICATED graphs showing the efficiency of loudspeakers, microphones, and amplifiers can now be made quickly and easily by the use of an ingenious machine recently invented. In doing this work in the past, engineers have been required to make hundreds of painstaking measurements and plot them on graph paper in a process that may take hours. Completely automatic, the new graph-drawing device plots a complete graph curve, showing the efficiency of the electrical instrument being tested, within two minutes. The curve is drawn by a moving pen point on a revolving drum covered with graph paper, the motion of the pen being governed by the reaction of the instrument on trial. In addition to saving time, the device is said to eliminate errors.

Public-Address System Travels in Army Truck



The system packed in the truck. A built-in generator powers it

DESIGNED to operate either from an outside power source or from a built-in generator driven by a gasoline motor, a high-powered, mobile public-address system recently designed for the U. S. Army Signal Corps is compactly housed within the body of a 2½-ton truck. Two collapsible, four-legged steel standards are set up to support sets of three powerful loudspeakers at a height of twenty feet above the level of the



One of the folding steel frames that support loudspeakers. Other speakers are inside the truck

ground. Additional loudspeakers are mounted within the truck and operate through grille openings at the sides. Sound recordings can be made and records played by the unit.

New Marbles Game Is Test of Skill



MARBLES are shot up a spiral track by means of a spring-operated plunger, in a new game just introduced. Eight numbered cups are spaced along the track, in which there are gaps to allow a marble to drop into the nearest cup when its centrifugal force is spent.



Marbles drop into numbered cups when their force is spent

Points are scored according to the numbers on the cups, and the player's object is to pile up the largest possible total with five shots. The track is durably made of steel.



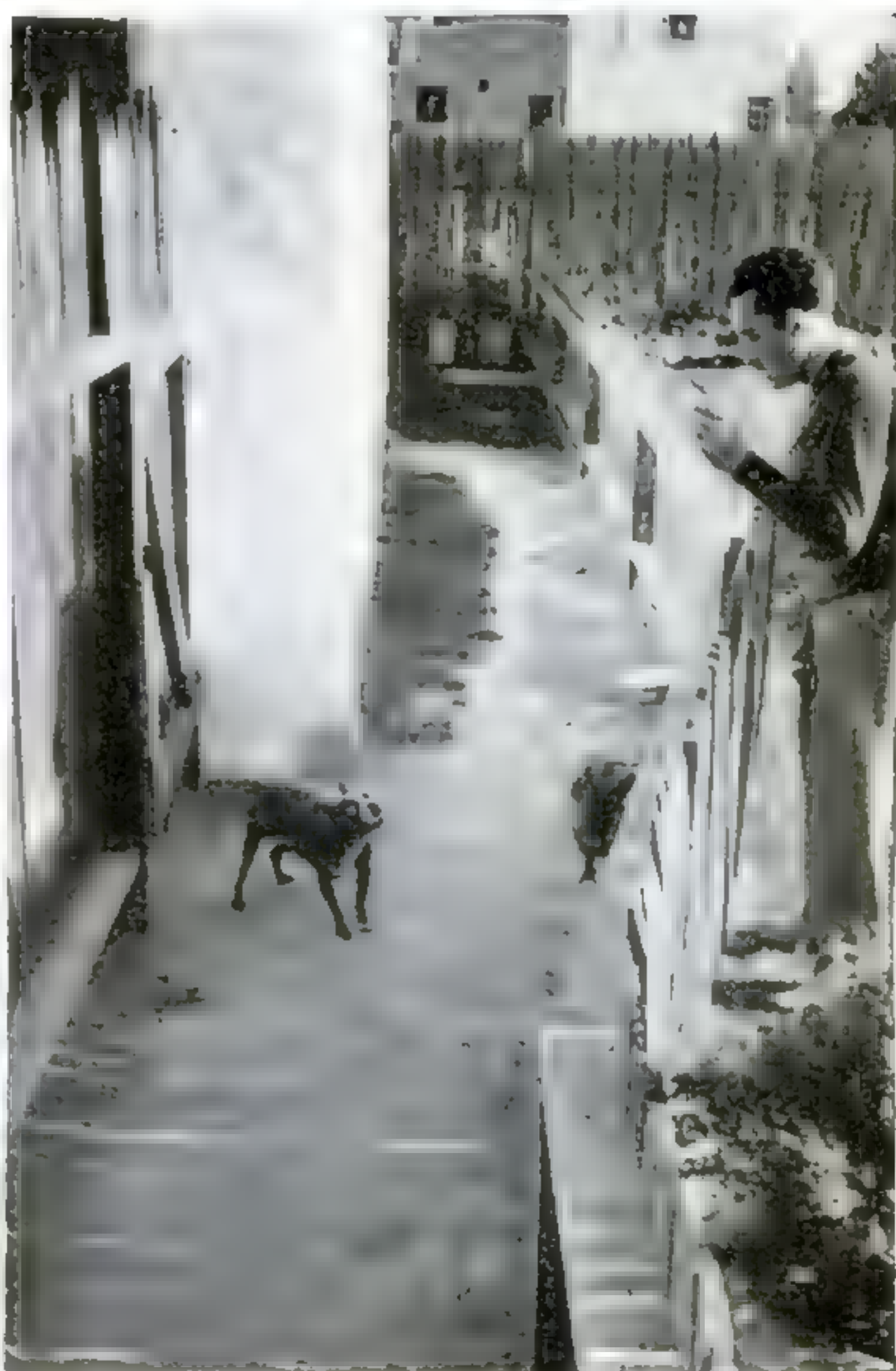
Model of proposed stratosphere transport undergoing wind-tunnel tests

"Stratoliner" Model Tested

DESIGNED to travel the upper skyways, 20,000 feet above the surface of the earth, a new "stratoliner" was recently tested in model form at the University of Washington wind tunnel, in Seattle. With a wing spread of 107 feet and a length of seventy-four feet, three inches, the proposed thin-air craft will be driven at a speed of 242 miles an hour by four huge power plants. Six of the planes will be built for swift coast-to-coast passenger travel.

Show Dogs Have Private Entrance to Owner's Home

TO PROTECT his two valuable show dogs from theft, and to control their activities around his home and its back yard, A. J. Schoendorf of Sacramento, Calif., constructed a special canine corridor and entrance to his house. From a closet in his den, a dog-size door leads into an inside corridor, one end of which opens onto a back porch where the dogs sleep, and the other onto a wooden ramp leading down to a fenced exercise yard that is equipped with a washing tub, grooming table, and dog shelter. The dogs can enter the house from the back porch or from the exercise yard whenever they wish, but they cannot go out again until their owner or someone inside the house opens the closet door, which also opens the outside door by means of a special pulley arrangement.



Exercise yard for dogs and, left, inner and outer doors of the corridor through which they can enter the house, but cannot go out until doors are opened



Twin rollers engage the car's rear wheels to measure its horsepower

Trailer Carries Car Tester

HORSEPOWER of automobiles is quickly determined by the portable testing trailer shown at the left. Cars are backed up a ramp until their rear wheels rest in the groove formed by twin rollers. As the rear wheels are spun by the car motor against the drag resistance of the rollers, a dynamometer, or power-measuring unit, within the tester's control cab checks the horsepower delivered. During the test a motor-driven blower forces air through the radiator to help cool the motor being tested.

You Can Play the Piano With a Mouth Organ

PLAYING a tune on the harmonica-type mouthpiece of a device invented by A. B. Conlisk, of Albuquerque, N.M., causes the same melody to be produced on a piano accordion, piano, or other instrument. Bellows in the mouthpiece operate an electromagnetic mechanism to trip keys or pluck strings.

The harmonica control connected to a piano accordion



The trunk ventilator resembles a gas-tank cap

Pets Ride In Car Trunk Fitted With Ventilator

DOGS, cats, and other household pets can be safely carried in the rear trunk of an automobile fitted with a new ventilating unit, according to the manufacturer. The vent, shown above installed in the side of the trunk, has adjustable openings for regulating the amount of air entering the compartment in warm or cold weather to keep the pets comfortable.

Stork Gets Wooden Leg

1 Found with a broken leg in a German forest, the stork was carried to a veterinarian

2 The injured limb was amputated and the bird was allowed to hobble about in a pen until the stump had healed up



AN INJURED stork, found not long ago in a German forest, was carried to a veterinary surgeon who amputated the bird's broken leg. Then the stork was taken to an artificial-leg specialist. How the bird was fitted with a specially carved, three-toed wooden leg on which it walks with ease, is illustrated in the novel photographs reproduced on this page.

Then an expert maker of artificial limbs was given the job of furnishing the bird with a wooden leg



4 Here the new leg is being attached. It is hand-carved and even has three wooden toes

5 A few days later, the bird is able to walk around again, almost as well as ever. The leg is seen in the inset



POPULAR SCIENCE *Question Bee*

How good is your knowledge of the language of science? In each of the items below, try to select the correct answer. Then check your list against the one on page 250, and figure up your score



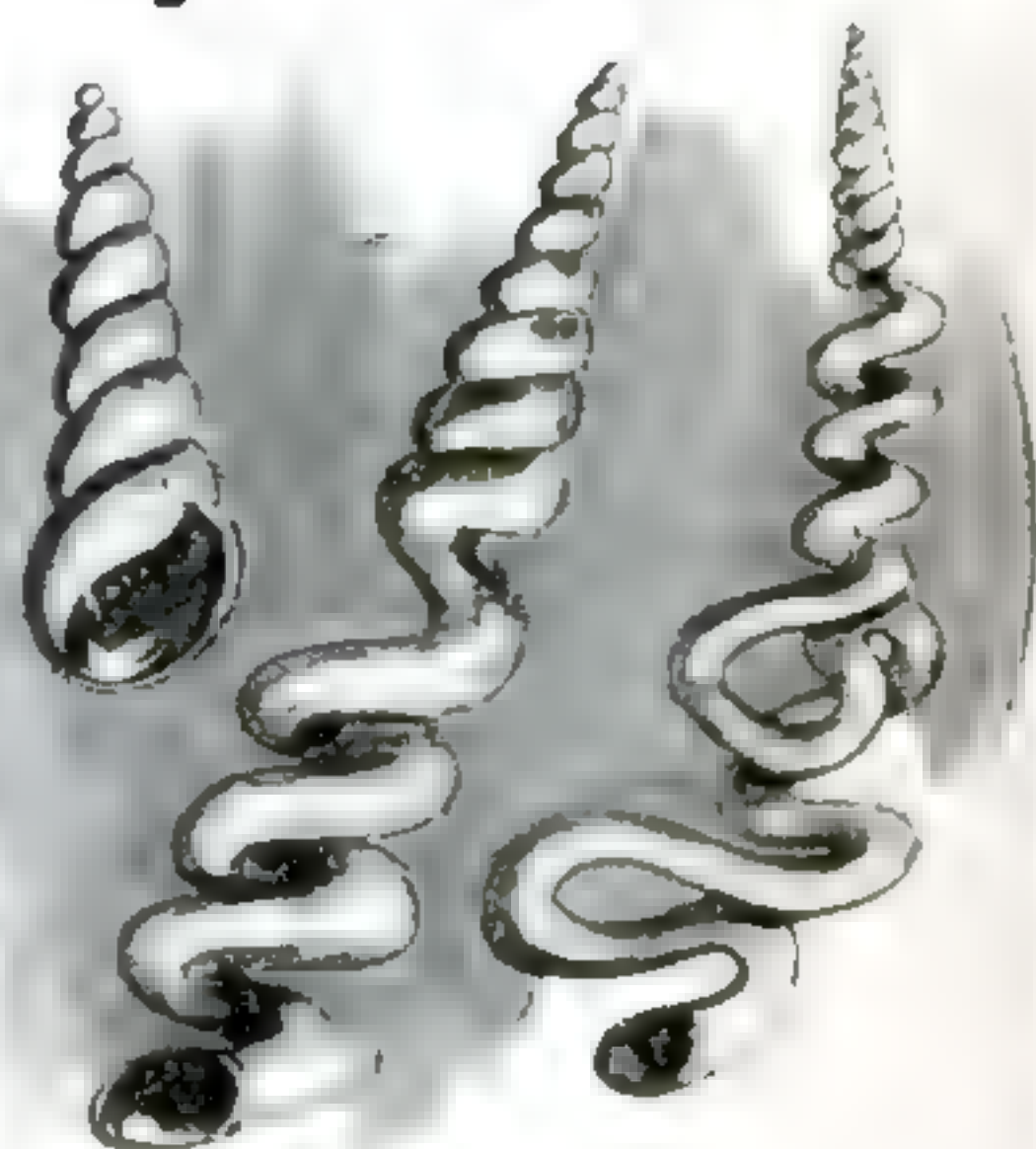
- 1 When he is ready to give the propeller a twirl to start the motor, an airplane mechanic sings out to the pilot, (a) "Tallyho!" (b) "Up ship!" (c) "Take it away!" (d) "Contact!" (e) "Scram!"
- 2 A prism breaks up white light into a multicolored band called a (a) fulcrum (b) plectrum (c) quantum (d) spectrum (e) tantrum.
- 3 An alienist (a) steals someone's affections (b) traces family trees (c) specializes in diseases of the mind (d) contends that a nation's racial stock benefits from an admixture of foreign blood.
- 4 Deposits of minerals transported by streams are called (a) alluvial (b) side-real (c) retrograde (d) sedentary.
- 5 Substage condensers are used upon (a) movie projectors (b) distilling apparatus (c) microscopes.
- 6 A chemical laboratory would be the place to look for (a) a C washer (b) a G string (c) an I beam (d) an S wrench (e) a T square (f) a U tube (g) a Y gun (h) an X axis.
- 7 Both men and monkeys, evolutionists hold, are descendants of an animal known as the (a) lemur (b) wombat (c) ocelot (d) gerrymander (e) peccadillo.
- 8 The big round thing with which compressed-air workers drive a tunnel under a river is called the (a) plunger (b) shield (c) auger (d) ram.
- 9 A moth's cocoon contains the (a) egg (b) larva (c) pupa (d) imago.
- 10 Baily's beads are (a) streamers of light seen through the moon's jagged rim at the beginning and end of a total eclipse of the sun (b) fused globules of borax used in chemical analysis (c) bits of glass, under great internal tension, that shatter into powder when lightly scratched.
- 11 A Stillson wrench is used to (a) drive airscrews (b) tune pianos (c) grip round things like pipes (d) grind auto valves (e) tighten the jaws of a micrometer upon an object to be measured with great precision.
- 12 Prehistoric savages who dwelt in caves are called (a) sybarites (b) saprophytes (c) proselytes (d) troglodytes.
- 13 A microtome is (a) a book of midget dimensions (b) a device for cutting microscope specimens into thin slices (c) a millionth of a tome.
- 14 Emery serves as (a) an adhesive (b) an abrasive (c) a lubricant (d) a detergent.
- 15 "Chromatic aberration" is (a) the use of clashing dissonances by composers of ultramodern music (b) color blindness (c) a defect in some lenses (d) the way a chameleon changes its colors.
- 16 Bacteria that inhabit the roots of peas and beans (a) spread the common cold (b) glow in the dark (c) kill earthworms (d) enrich the soil with nitrogen from the air.
- 17 Ambergris comes from (a) muskrats (b) jasmine flowers (c) civet cats (d) whales.
- 18 Green plants manufacture food by (a) sublimation (b) inflorescence (c) photosynthesis (d) lactation.
- 19 The Leonids are (a) morning stars (b) variable stars (c) pole stars (d) shooting stars (e) movie stars.
- 20 Marsupials (a) travel in a cluster between Mars and Jupiter (b) carry their young in a pouch (c) help mathematicians solve complicated equations.

Un-Natural History

By
GUS MAGER



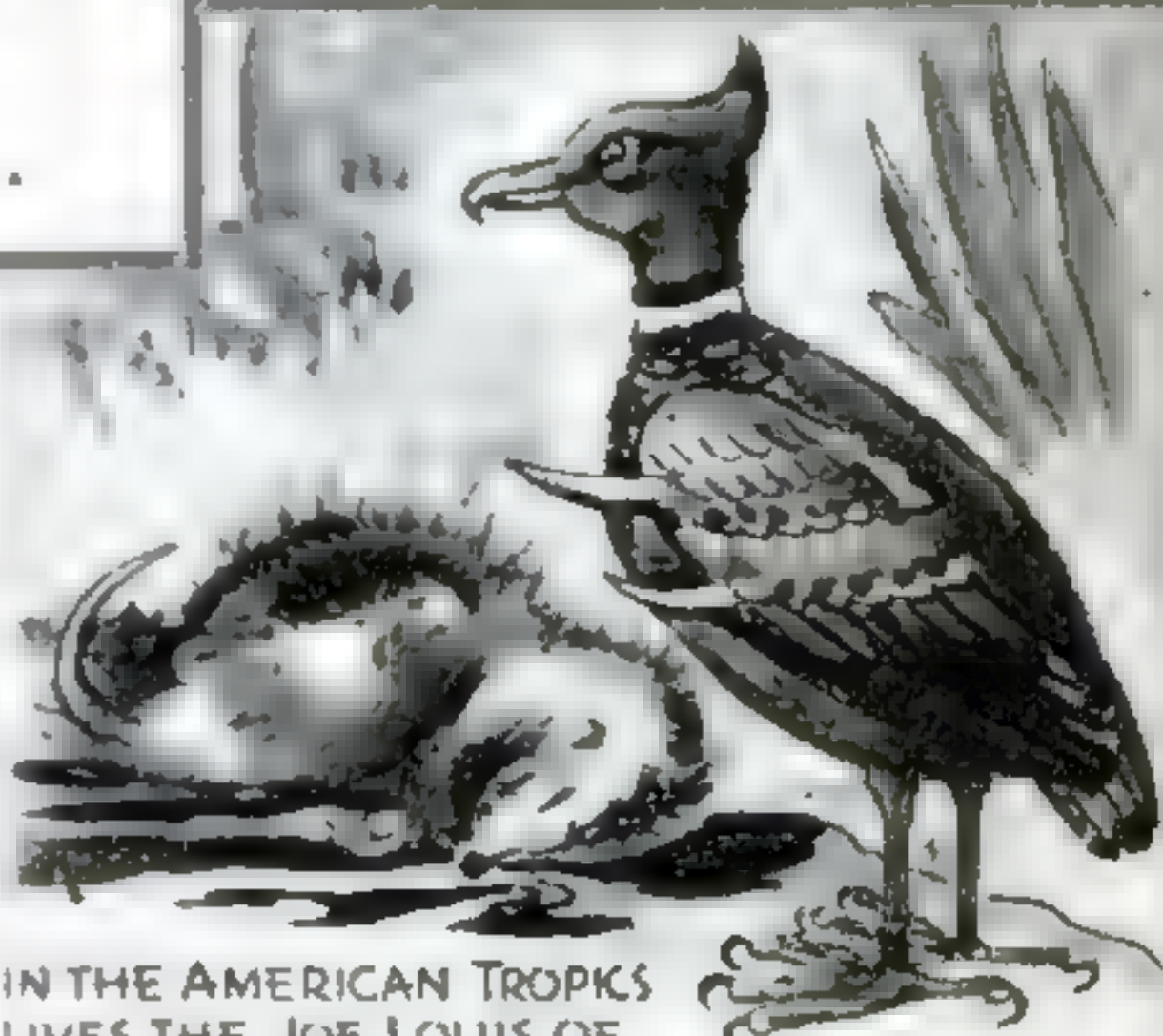
THE LION RESEMBLES THE OTHER MEMBERS OF THE CAT FAMILY IN HAVING RETRACTILE CLAWS, BUT HE IS THE ONLY ONE THAT HAS A MANE AND A TUFTED TAIL WITH A HORNY SPIKE AT THE END!



BEGINNING LIFE IN A SYSTEMATIC, CLOSE-WHORLED HOUSE, THE VERMETUS, OR WORM SHELL, SOON GROWS CARELESS AND FINALLY GOES COMPLETELY HAYWIRE, DOUBLING AND TWISTING ITS SHELL IN CRAZY LOOPS!



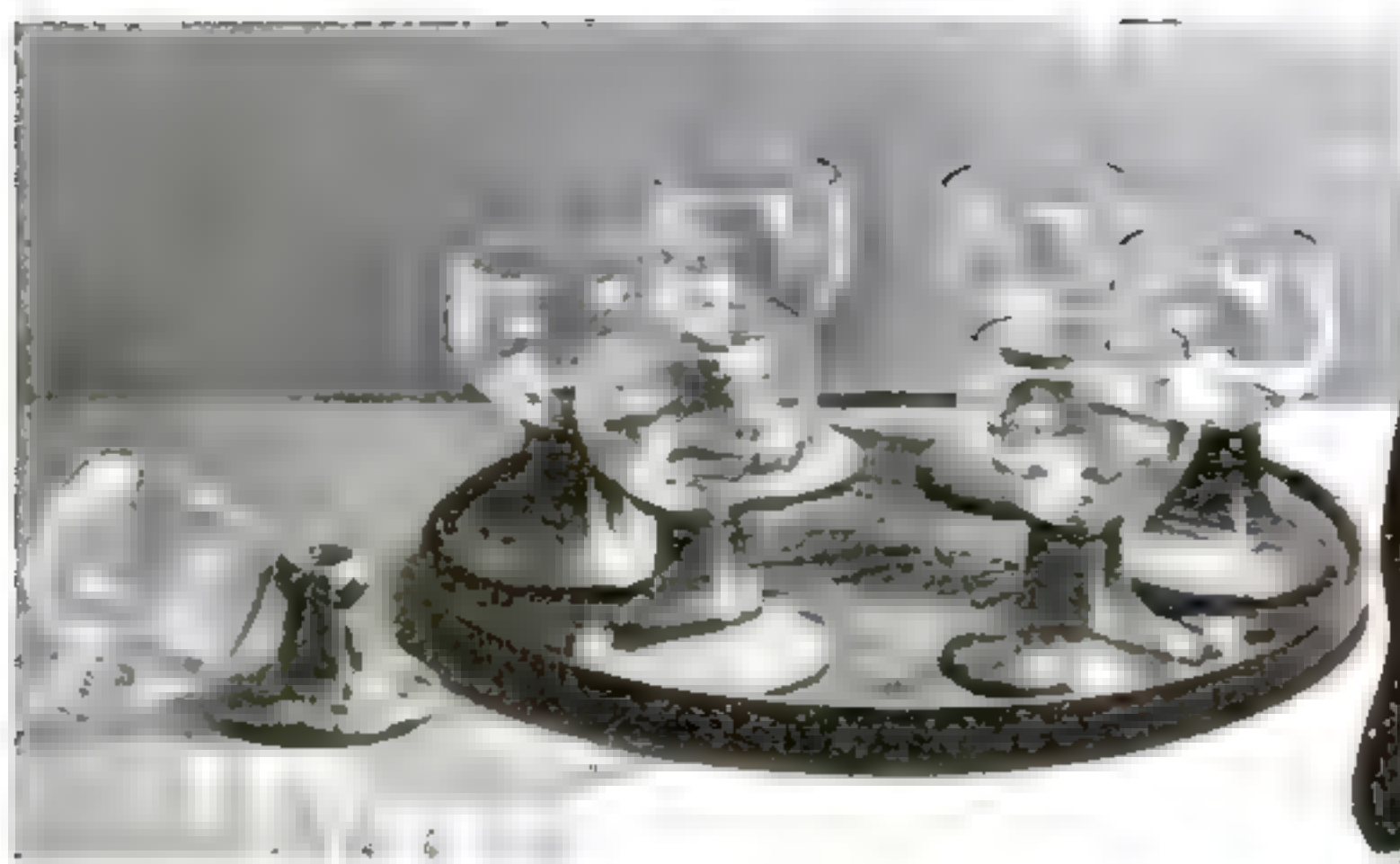
TERMITE SOLDIERS ARE ARMED WITH BLOWGUNS! THROUGH A LONG TUBE IN THE FRONT OF THE HEAD, THEY SQUIRT OUT A GLUEY, ILL-SMELLING LIQUID THAT GUMS THE WORKS OF INSECT ENEMIES!



IN THE AMERICAN TROPICS LIVES THE JOE LOUIS OF THE BIRD WORLD—THE SCREAMER. IN ADDITION TO HIS CRUEL BEAK AND CLAWS, HE HAS DAGGERLIKE SPURS ON HIS WINGS, WITH WHICH HE JABS OTHER BIRDS AND EVEN LARGE ANIMALS TO DEATH!



MOUNTAIN LAURELS ARE SHRUBS, BUT A GIANT SPECIMEN FOUND IN THE GREAT SMOKY MOUNTAINS (NORTH CAROLINA—TENNESSEE) HAS A BUTT EIGHTY-TWO INCHES IN DIAMETER, AND LIMBS AS BIG AS SMALL TREES!

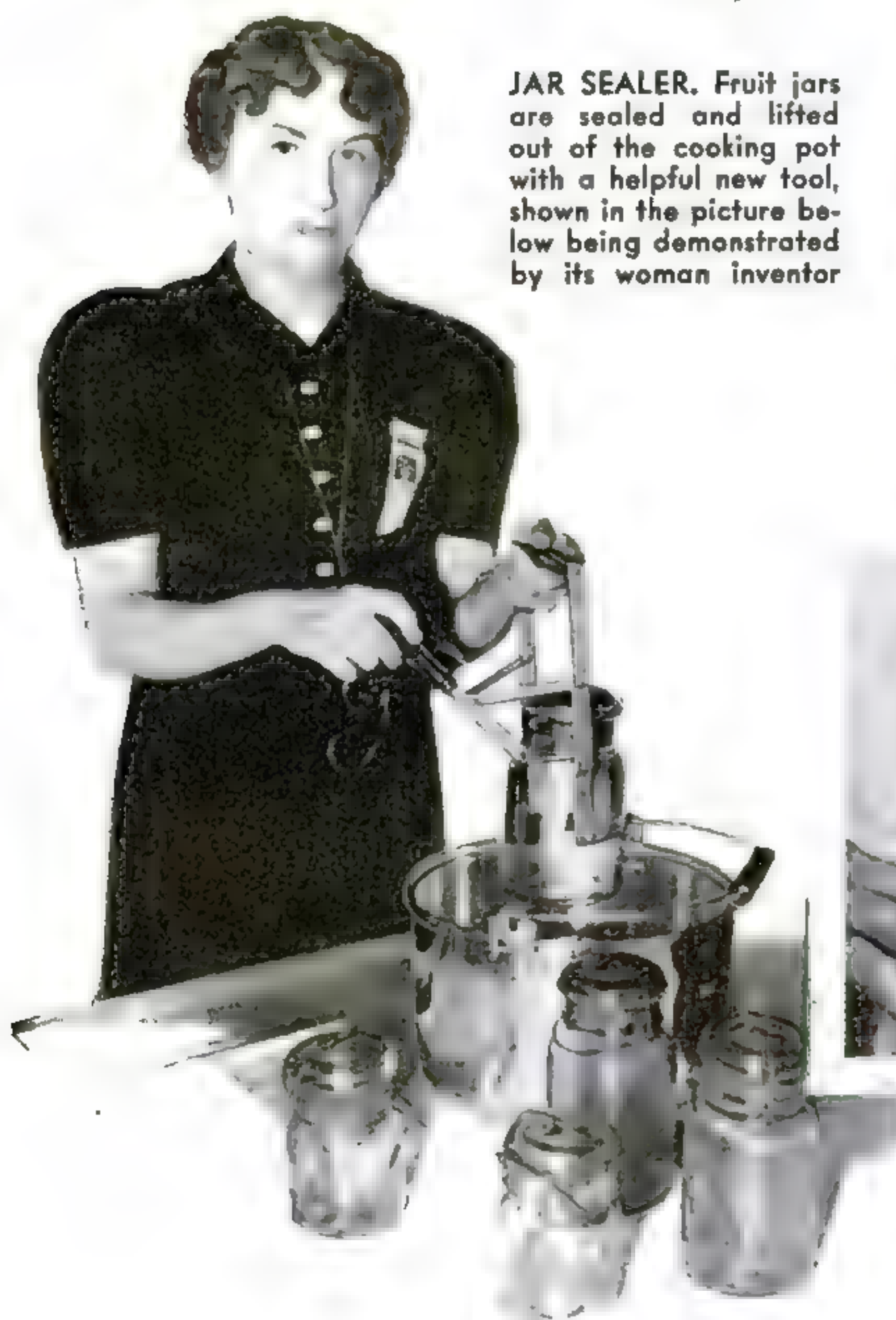


WOODEN-STEM GOBLETS. Wooden bases take the place of glass stems in the goblets pictured above. When a glass is broken, it can be replaced

ELECTRICAL-DEVICE CABINET. Serving as a base for an electric mixer, this cabinet also provides space for other kitchen electrical devices. The side cover swings up as a working surface with the mixer attached, as illustrated



JAR SEALER. Fruit jars are sealed and lifted out of the cooking pot with a helpful new tool, shown in the picture below being demonstrated by its woman inventor

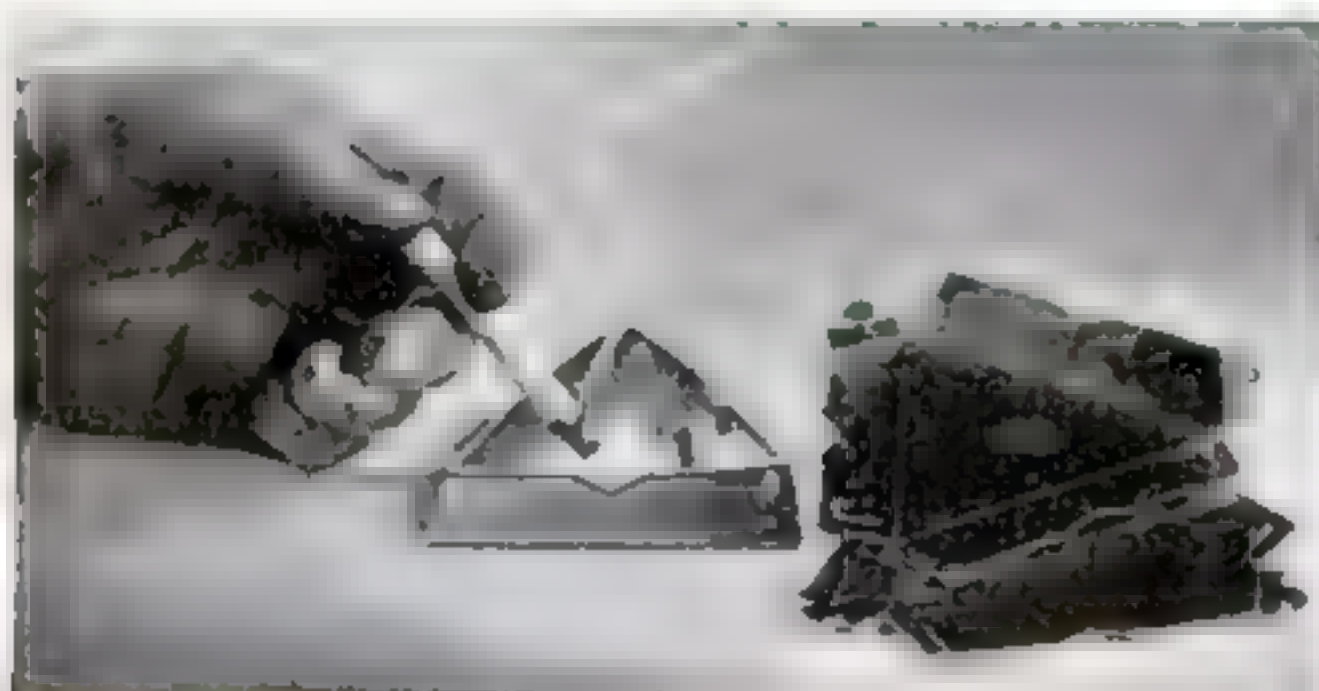


HANDY PASTRY CUTTER
The scalloped cutting wheel of this versatile utensil cuts neat crisscross pie covers, while the ridged handle is for crimping





FIREPLACE ROTARY ROASTER. Chickens, ducks, and other meats are literally "done to a turn" at the fireplace with the device shown. An electric motor turns the spits, and a stainless pan catches juices

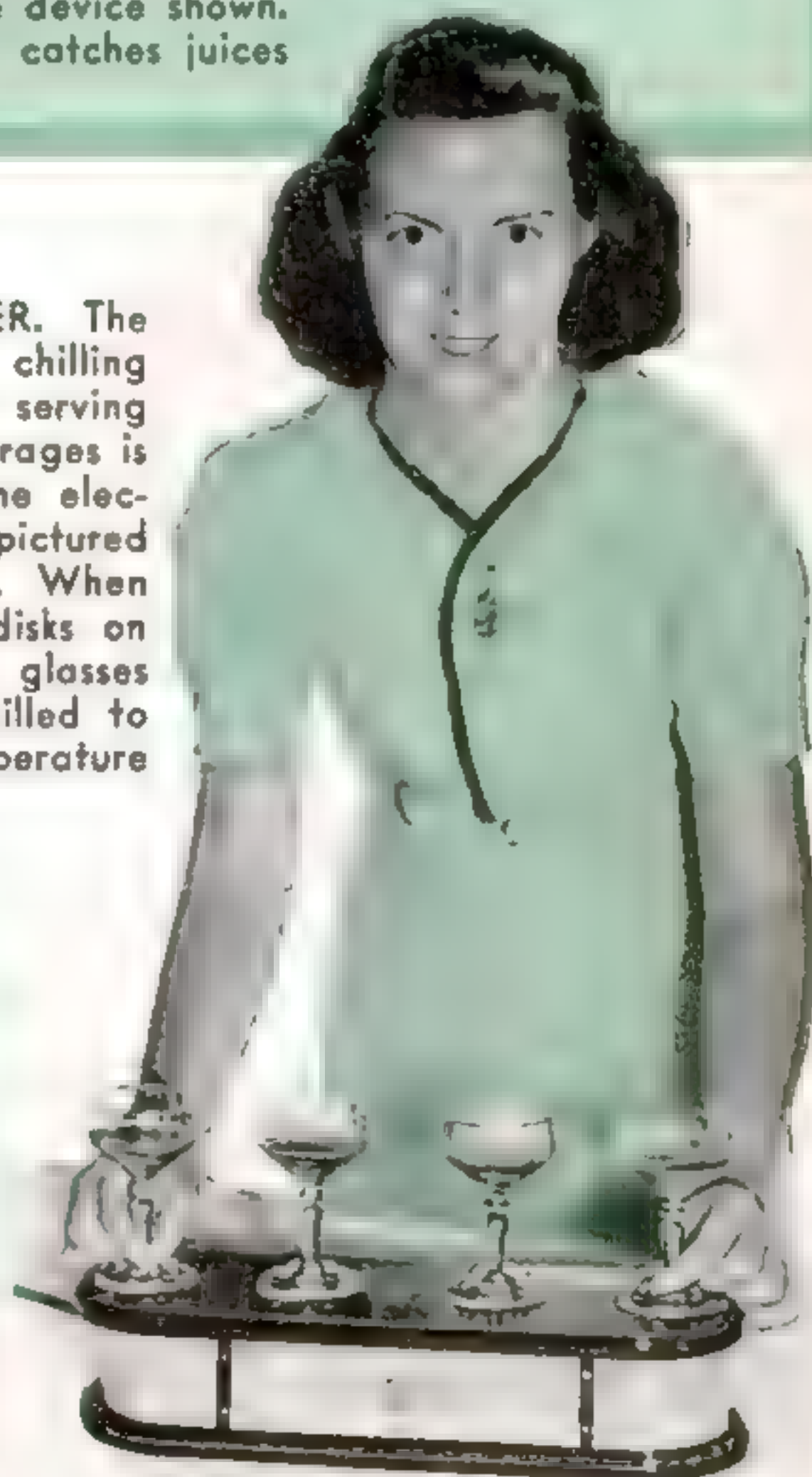


COLLAPSIBLE ASH TRAYS. Made of cardboard fireproofed with metal foil, collapsible ash trays can be carried easily, or stored for party use. After using, they are thrown away

CLIP-ON OUTLET
Electric outlets can be had wherever wanted by the use of a receptacle unit that clips between the wall and the base-board or other wood-work. It is connected to the nearest built-in outlet by a cord held by clips



GLASS ICER. The problem of chilling glasses for serving certain beverages is solved by the electric unit pictured at the right. When placed on disks on the top, the glasses are soon chilled to the right temperature



for the Homemakers

Queer Troubles

"O H, WELL—let it slide," Jack Simpson said carelessly to Harry, the Model Garage's earnest young mechanic. "Probably it doesn't amount to anything—but if it does it'll get worse, and then we won't have any trouble locating it."

Gus Wilson had come in quietly from an errand downtown and was hanging up his coat. "That's one way of owning a car, Jack," he remarked, "and, to tell the truth, it's a pretty popular way. But it's often a darned expensive one. What's your trouble?"

"Oh, hello, Gus. I didn't see you come in," Simpson said. "Why, I wouldn't call it trouble—not real trouble. While we were on our vacation last week we had a little difficulty—left rear wheel brake dragged a bit. I had the people in the garage of the hotel where we were staying look at it. They said that something had gone wrong with the brake cylinder in the wheel, and charged me three bucks for adjusting it. Now Peggy says that all the brakes drag a little—I haven't noticed it myself—and she thought I'd better come in and let you take a look at them. But there doesn't seem to be anything really wrong, so I guess it isn't worth bothering about."

"What did they do to that wheel cylinder?" Gus wanted to know.

"I dunno," Simpson admitted, grinning. "I was playing golf while they were working on it, and afterward I never thought to ask them."

"Peggy's a smart girl," Gus assured him. "But she wasn't so smart when she married a guy who lets his car cost him more than it should just because he's too careless to check up on the little things. You'd better leave your car here for a couple of hours, Jack, and let me give those brakes a good looking over."

"All right," Simpson agreed. He had barely left the garage when Joe Clark stuck his head in at the office door. "Hurry call for the wrecker!" he announced. "From Old Man Parsons. Says he couldn't get his car started this morning. Wants you to tow it

over here and fix it up—and he's got to have it back in an hour. Better step on it!"

Half an hour later, Harry drove up to the shop door, towing the Parsons car. A peppery old gentleman was with him, and Gus could see that Harry hadn't been having a happy ride.

"It's preposterous!" snapped Parsons, jumping down as soon as the car stopped. "Mr. Wilson, my car was overhauled here less than two weeks ago. When I paid my bill, Mr. Clark assured me that everything was in excellent condition. But this morning my car refused to start! I tried. My next-door neighbor tried. Then his hired man attempted to turn the motor over with a crank. But it was no use. I had to walk to my office—and I was ten minutes late! I insist that you—"

"Sure thing, Mr. Parsons," Gus said soothingly. "I'll fix things up. Roll her in, Harry."

Gus tested the battery. It was strong, but not nearly strong enough to kick that balky engine into action. He tried everything he knew, but he couldn't get the engine to turn over. Harry, watching him, saw that for once he was thoroughly stumped.

While Gus was scratching his ear, Harry aimlessly pulled out the oil-gauge rod and looked at it. Then he looked at it more intently, and held it out for Gus's inspection. It was covered with a gummy substance as thick as transmission grease.

"What sort of oil have you been using lately, Mr. Parsons?" Gus asked.

"Oil? The oil that you put in my car!" the customer replied tartly. "I've been driving very little, and have had no occasion to add any."

Gus poked an exploring forefinger into the messy stuff on the gauge rod, then touched the smeared finger to the tip of his tongue, and frowned. "Drain the oil, Harry," he directed. It oozed out very slowly and was thick and gummy. An examination of the engine showed that pistons and bearings were sticky with it.

"You'll have to leave your car with us for a day," Gus told the car owner. "We'll have to take the engine apart, and clean it thoroughly. Some one played a little joke on you—a mean one, too. They put sugar in your oil, probably while you had your car out last night. I can taste it—and I saw that trick pulled once

**Sugar and Oil Make a Bad Mixture for a Car,
and So Do Oil and Hydraulic-Brake Fluid, as
a Day's Work at the Model Garage Reveals**

By MARTIN BUNN

with OIL

Harry aimlessly pulled out the oil-gauge rod and looked at it. Then he looked at it more intently, and held it out for Gus's inspection. It was covered with a thick, gummy substance



Illustrations by FRANK HUBBARD

before. Your drive home was just long enough for the sugar to dissolve in the oil and turn it into a gummy grease that set hard while the car was standing overnight, and stuck the pistons to the cylinder walls so tight that the engine can't turn over. There won't be any permanent damage, but it's going to be pretty close to a day's job getting the mess cleaned up."

"Hooligans!" roared the customer. "I'm going to the police and see to it that they—"

He went out fuming. Gus and Harry looked at one another, and couldn't help grinning. Then Gus shook his head. "It's nothing to

laugh at, at that," he said. "It was a dirty trick—the sort of bum joke that causes a lot of trouble and expense. I suppose that some of the kids around town have it in for the old grouch, and maybe he had it coming to him—but I do hate to see an engine abused! Well, we'll get at the clean-up job tomorrow. Now let's get Jack Simpson's brakes checked. I'll drive his car around the block a couple of times, and see how they act."

When Gus drove back into the shop, ten minutes later, he beckoned Harry over to the car. "Hop in here and step on the brake," he said as he got out. "Then tell me how it

feels to your dainty little size fourteens."

Harry got in and pressed his foot down on the brake pedal. "Feels as if it was working on a wet sponge!" he reported.

Gus nodded. "That likely means one of two things," he said. "Either that the brake shoes are out of adjustment, or that air has somehow got into the hydraulic system. But there's something else. All four brakes on this car drag a little—just as Peggy told Jack they did."

"What's that a sign of?" Harry wanted to know.

"It usually is a sign that you've got quite a job on your hands," Gus told him. "You're clear on how hydraulic brakes work, aren't you? When you press your foot down on the brake pedal, the pedal's connection forces the piston of the hydraulic system's master cylinder inward. That exerts pressure on the brake fluid in the master cylinder, and forces some of it through the copper pipes that connect the master cylinder with each of the four wheel cylinders. Then the fluid exerts equal pressure on the pistons of each of those four cylinders."

"Sure," Harry nodded. "But what makes Simpson's brakes drag?"

"Well," Gus went on, "the pressure exerted by the brake fluid on the wheel-cylinder pistons forces them outward against the brake shoes so that the linings are forced against the brake drums, creating friction that causes the brakes to drag a little.

"When you take your foot off the brake pedal, the pressure from the master cylinder is removed from the wheel-cylinder pistons. Then the return springs on the brake shoes force the pistons inward, and the pistons force the brake fluid back into the master cylinder."

At Gus's direction, Harry disconnected the copper tubing at the hose union on one of the wheels and removed the brake cylinder. Squatting beside him, the veteran mechanic continued:

"On this car the brakes drag—they don't return promptly to the 'off' position when the pressure of your foot on the brake pedal is removed. If only one brake dragged, the most likely cause would be a return spring that wasn't working properly. Maybe all that would be necessary would be to clean it off well; but more likely it would have lost its contracting power, in which case you'd have to put in a new spring.

"But when all four brakes fail to return promptly to the 'off' position it's a sure sign that the trouble is in the entire hydraulic system. And it's almost certain that it is caused by engine oil or kerosene—any mineral oil—having somehow got into the brake fluid. Even a very little of it will cause the fiber cups in the master and wheel cylinders to swell out of shape, so that the cylinders will not work properly. When that happens the brake fluid is prevented from returning promptly to the master cylinder, and its pressure keeps the brake bands

in contact with the brake drums, and causes drag.

"Remember what Jack said about having some trouble with one of his wheel cylinders, and having it taken care of at the garage attached to a country hotel? That's the tip-off. In fixing the cylinder the garage men probably washed its parts in kerosene, and the kerosene has worked all through the hydraulic system. See here—"

Taking the cylinder apart, he showed Harry how the fiber cups were swollen and distorted. "Now let's get busy!" he said. With Harry's help he removed all the cylinders. After washing the parts thoroughly with brake fluid, Gus replaced the cups with new ones, and reassembled and replaced the

(Continued on page 248)

At Gus's direction, Harry disconnected the copper tubing and removed the hydraulic-brake cylinder



THE HOME WORKSHOP



COLOR PHOTO BY G. K. NORDHAUSEN

*In This
Issue*

DOPEY AS A MARIONETTE TAKE YOUR PHOTOS CLOSE UP!
MODEL OF OLD-TIME SHIP'S CANNON TABLE-LAMP RADIO
MERRY CHRISTMAS



SNOW WHITE HERSELF Marionette ... AND YOU CAN EASILY

Our special kit for Dopey comes to you ready to assemble as shown at the left. Below, using pliers to attach Dopey's head to his body

HOW would you like to bring little Dopey into your home to romp and caper just as he did in Walt Disney's animated fairy tale, "Snow White and the Seven Dwarfs"? He'll repeat every antic you saw him perform on the screen and carry out your every wish—all because he's been made over as a marionette.

POPULAR SCIENCE MONTHLY has just had a special assembly kit prepared with the completed parts (head, arms and hands, body, feet, a suit of blue pantaloons and orange coat, control stick, string and wire) for putting together a marionette of Dopey 9" high. It is the simplest yet most effective construction kit of its kind ever offered. You can assemble the little dwarf, clothe him in his colorful costume, and attach the control strings in half an hour.

Dopey, the marionette, is just as lovable as Dopey, the movie star. It's fun making him jog along,

Mme. Bee Alexander, noted the world over for her dolls, designed the puppet from color sketches by Walt Disney



'WOULD LOVE TO PLAY WITH THIS of Dopey ASSEMBLE ONE JUST LIKE IT

swing his arms about, bow to the audience, and gesticulate in his own comical way. No experience and very little practice are necessary to manipulate him. The standard or so-called "airplane" control has been discarded in favor of a new and simpler system of stringing that is essentially a one-hand control.

Mme. Bee Alexander, of New York, noted doll designer, fashioned the marionette in collaboration with Walt Disney. The figure on the movie screen was studied with utmost care, and the puppet is so balanced and strung that identical movements may be obtained. The head is delicately modeled and painted by hand to resemble the same coy, impish face the world has grown to love.

Thousands of dollars were spent in developing this marionette, but our readers may obtain the assembly kit for only \$2.25. (If you live west of the Mississippi River or in Canada, add an additional 25 cents.) Send check or money order to the Marionette Editor, POPULAR SCIENCE MONTHLY, 353 Fourth Avenue, New York. If you prefer, you can use the coupon given with our complete list of construction kits, to be found elsewhere in the magazine.

To put the marionette together, first fit the trousers over the shoes and make them fast by twisting the wires already in the hem. Fit the body into the other end of the trousers and use a small thumb tack on each side to hold the trousers in place. Insert the hooks on the ends of the arms into the corresponding loops on the body and close both with pliers. Hook the head on the body and



Dopey can perform with all his ingratiating little mannerisms. At left, the joints and strings (jacket omitted for clearness)

close the loop with pliers in the same way. Then dress the puppet in the orange jacket supplied with the kit.

Hook the end of the wire controller through the wire loop on top of Dopey's head and squeeze the hook shut. Next take one of the strings you will find fastened in the box near the feet. Knot one end of this and thread through the large needle supplied for the purpose. Pull the string through the hem in front of the left ankle where the trousers join the leg. Do the same with the other piece of string and the right foot. Take the loose ends and attach firmly to the saw cuts on the wooden crossbar of the control; pull tight enough so that the marionette hangs in a natural position.

Now take the longest string included in the kit and attach to one hand through the hole between thumb and forefinger. Run the other end through the loop on the front of the



Sketches of parts supplied in the kit. At right, Dopey's arms are raised by slipping the right thumb under string leading to both his hands. He bows if the rear string to his belt is pulled



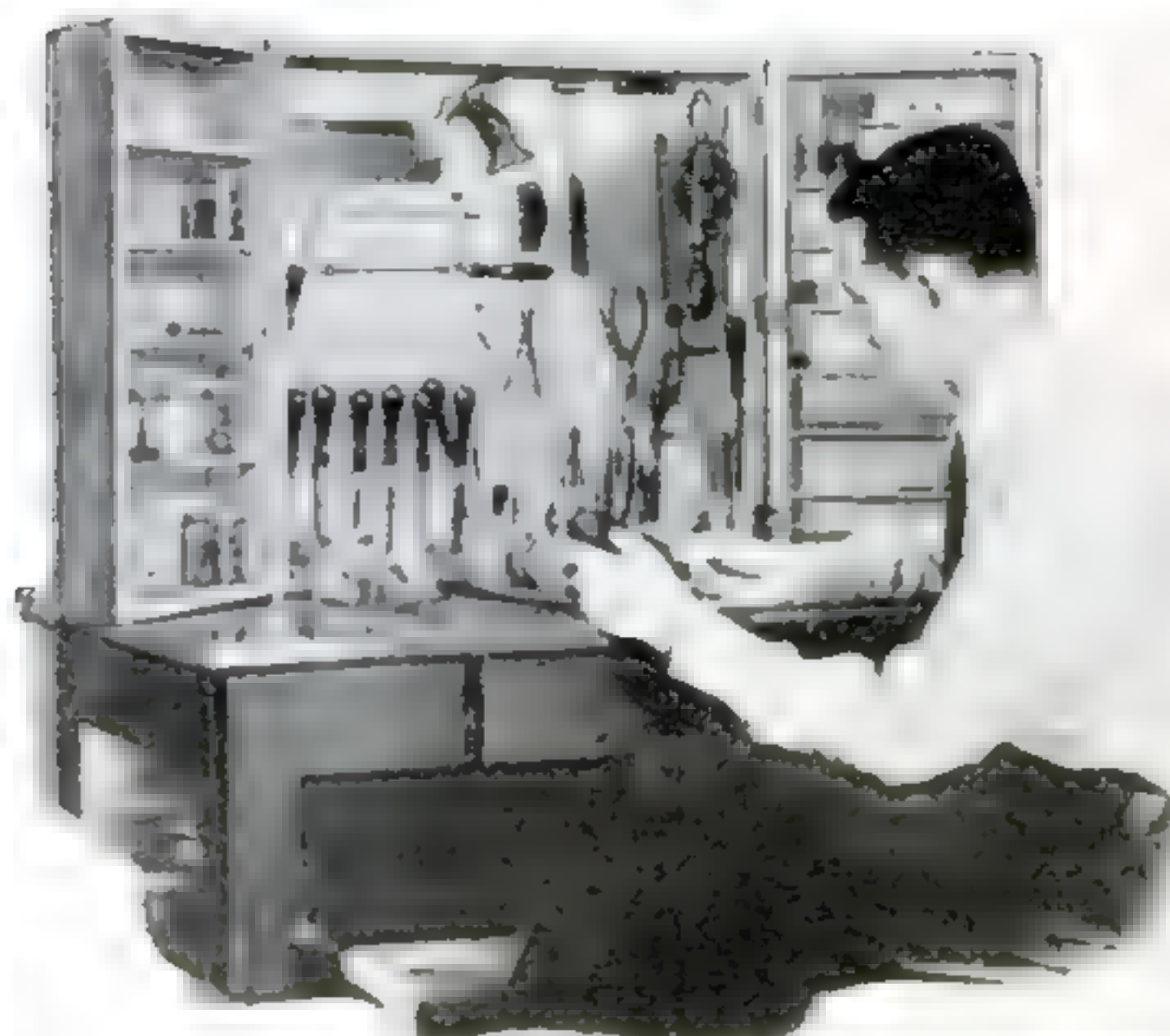
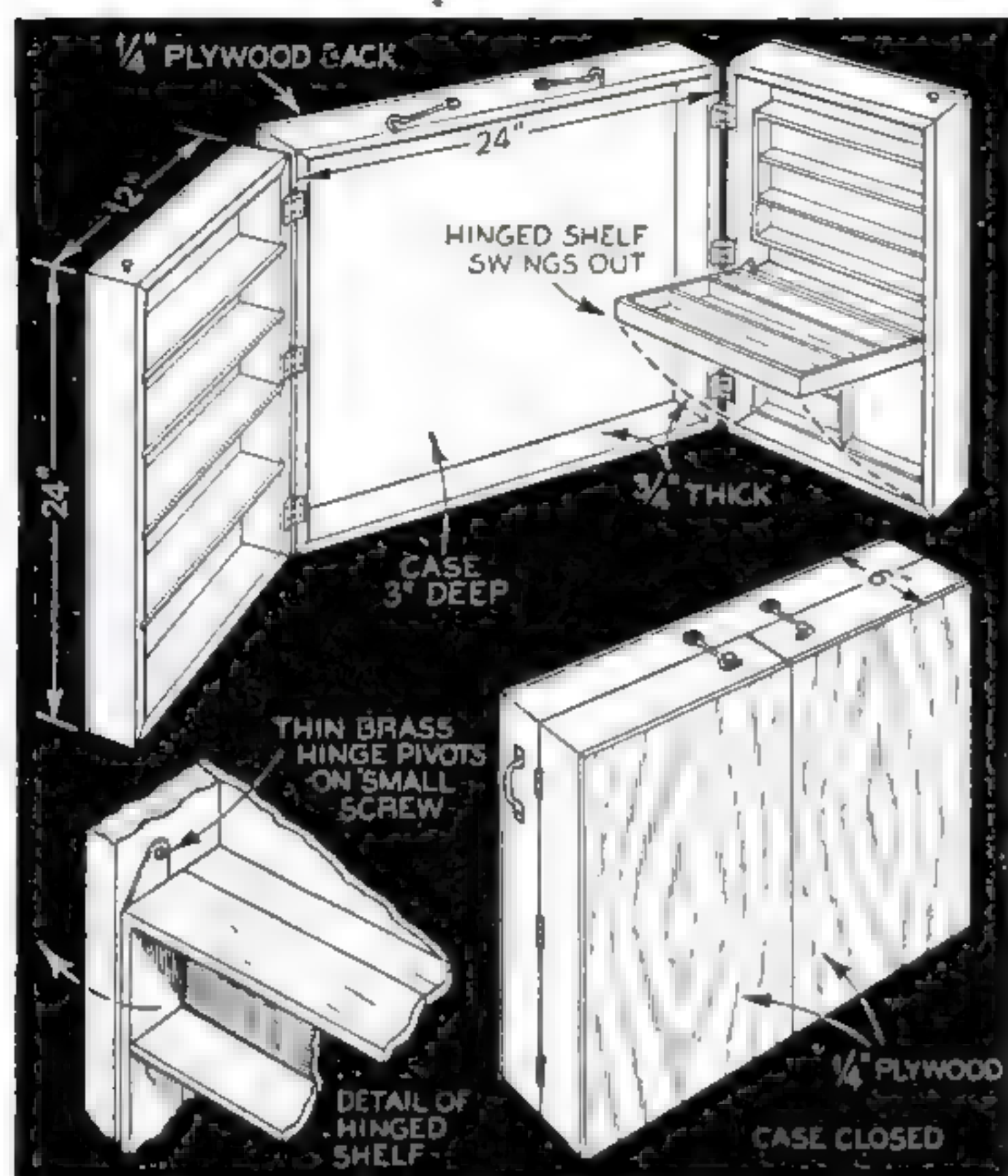
wire control and down to the other hand, where it should be fastened. Turn the puppet around, pull the shortest string through the belt and jacket with a needle, and knot the end on the inside of the jacket. Tie the other end of this string to the wire handle in back of the crosspiece. It is this string that enables Dopey to bend and bow.

To manipulate Dopey, partly close your right hand in the form of a hook, rest the wire loop on the inside of the last three fingers, and place the thumb and forefinger on top of the crosspiece near the ends as shown. Hold the control high enough so that the feet just rest on the stage floor, table, or other surface. Seesaw the crosspiece up and down and gradually move the control forward to make Dopey walk. You can imitate the peculiar gait he had at times by resting one foot firmly on the stage so as to drag and moving the crosspiece up and down so the other foot steps forward.

Reach out your thumb and pull at the front strings to make his hands move. Dopey will say "yes" if the control is jiggled up and down. Turn the control from side to side to indicate "no."

For stages and accessories, refer to our booklet, "How to Make Your Own Marionettes," price 50 cents.

Tool Cabinet Converts Any Table into a Workbench



A blotter or piece of wall board protects the table top. Left, drawings of the cabinet



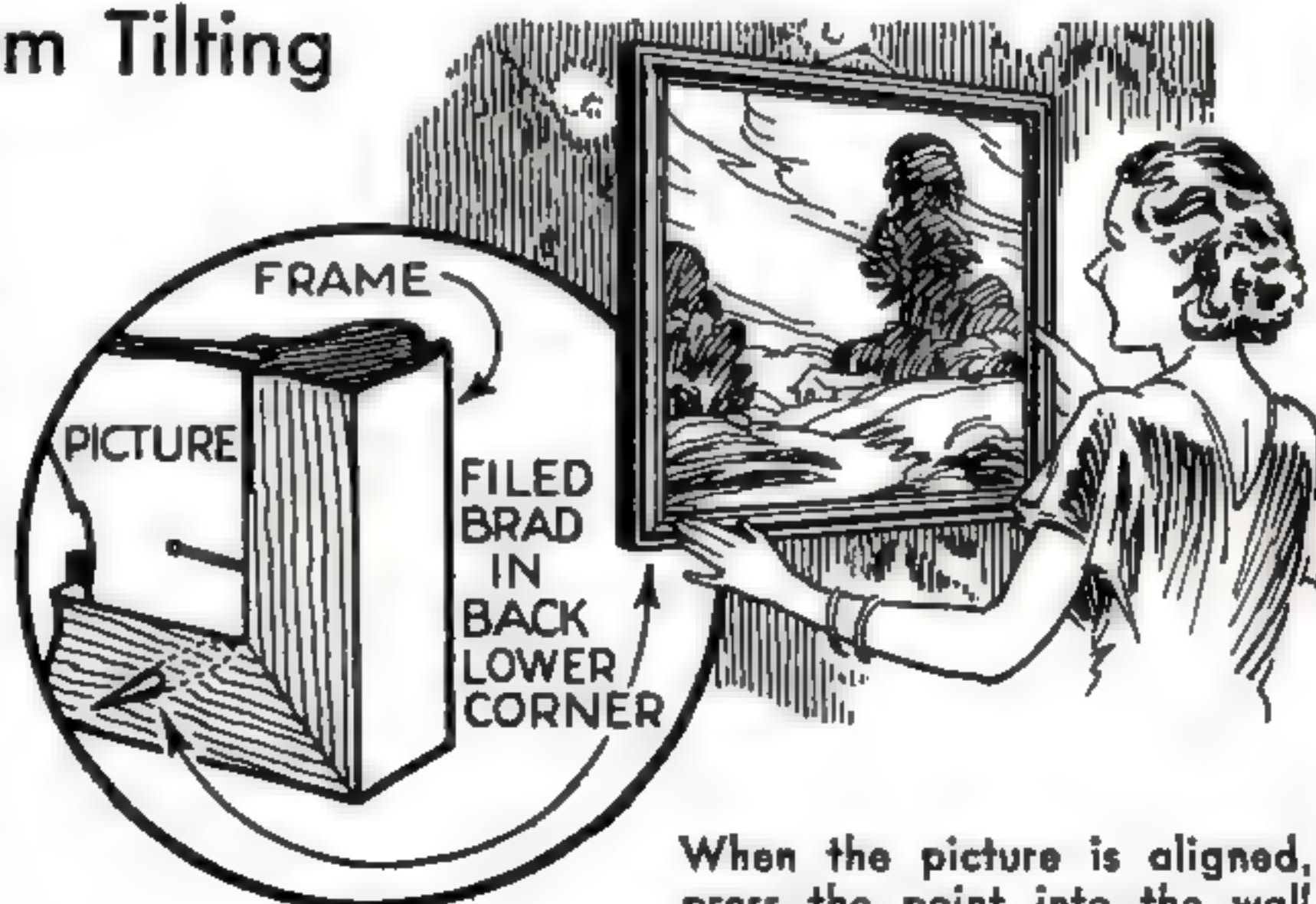
Shelves at front raised to show space for vials of odds and ends

FOR those who live in a small apartment, this folding tool cabinet will be found useful. Although only 24" square and 6" deep, it holds all the small tools necessary for building ship models or miniature railroad equipment.

The sides are of $\frac{3}{4}$ " white pine 3" wide; the back and front of $\frac{1}{4}$ " plywood. To hold many small bottles of brads, screws, nuts, and the like, a special set of shelves was placed in the lower part of the right-hand door. Two ready-made trays of thin wood, made to fit a kitchen-table drawer, were used. These were stood on edge, the one on the back being fastened directly to the plywood back of the door; the other is hinged at the top so that it swings outward at the bottom, giving access to the shelves behind. Handles are fastened at each side near the top so that the cabinet can be readily lifted.—J. W. CLEMENT.

Brad Keeps Frame from Tilting

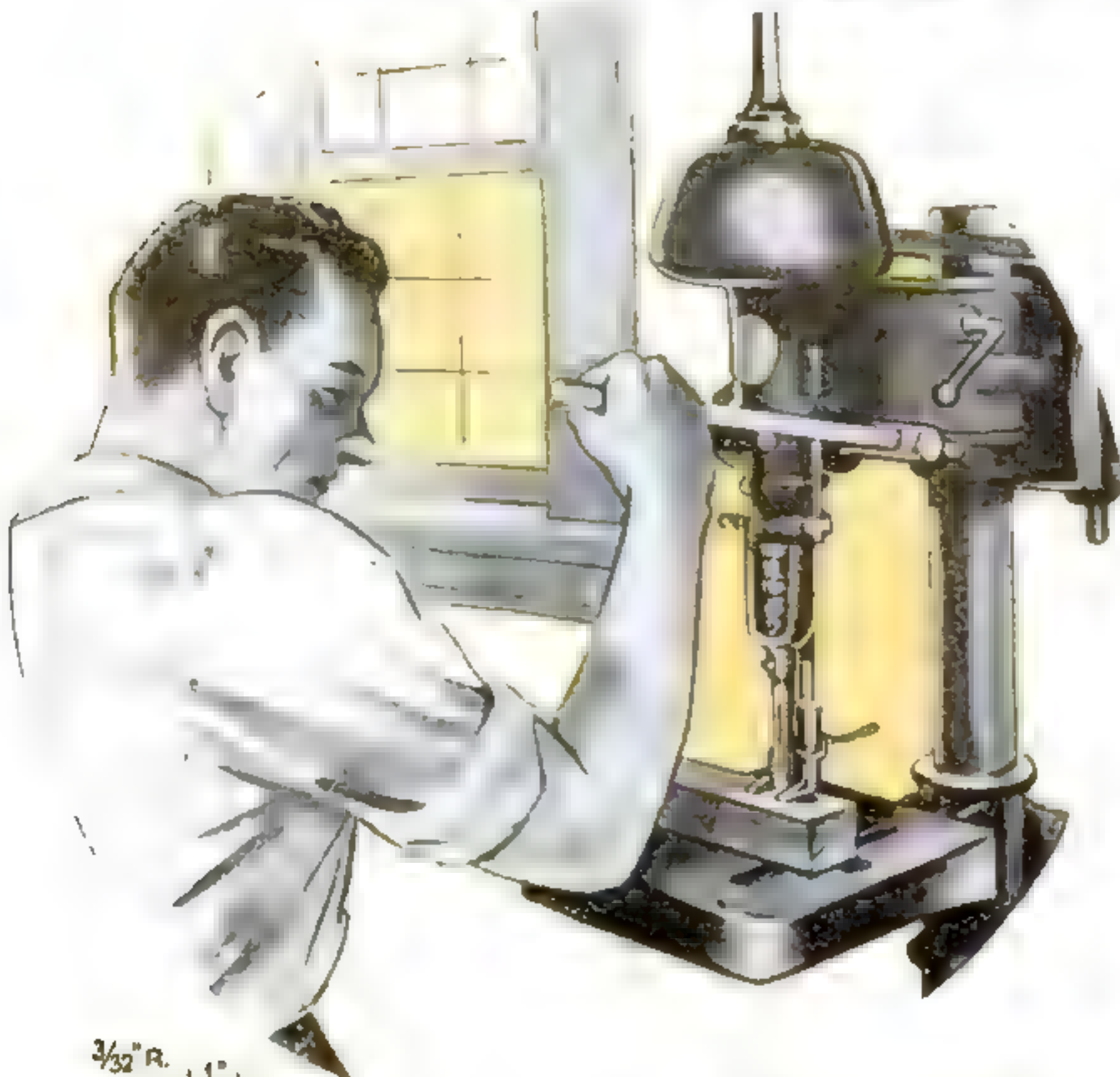
PICTURE frames hung from a single nail or hanger often tilt out of level because of the slight vibration of the walls or because they are disarranged when dusted. To overcome this, a small brad may be driven halfway into one lower corner of the frame at the back, as shown at right, and filed to a sharp point. Once the picture is leveled, all that is necessary is to press that corner against the wall so the point catches in the plaster. Always be careful to lift the picture away from the wall before moving it.—STEPHEN A. FRITSCH.



When the picture is aligned, press the point into the wall

LAMP TABLE

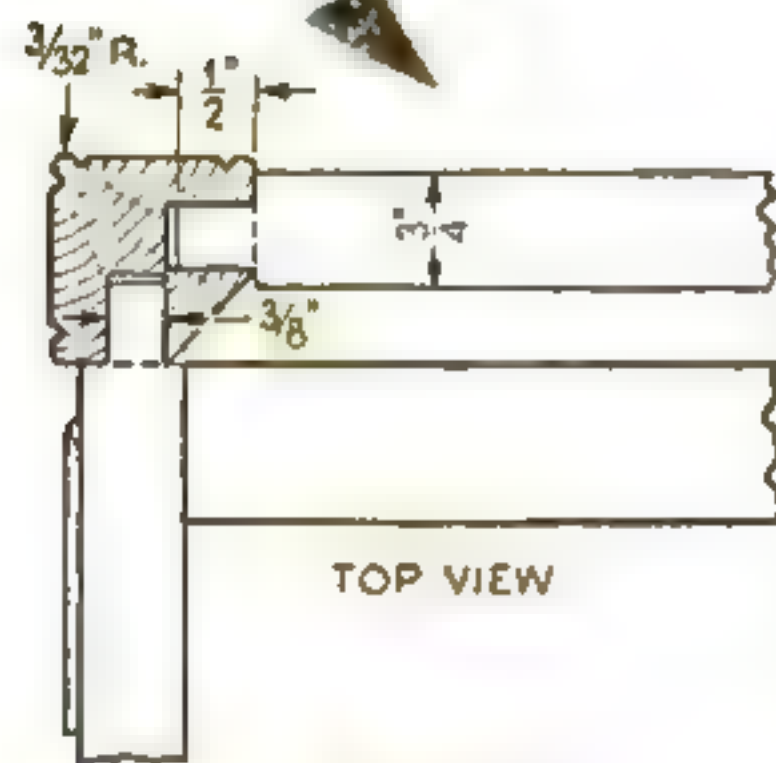
IN CHINESE-CHIPPENDALE STYLE



ALMOST every homemaker desires to have at least one small table in the style of the great furniture masters such as Chippendale. This living-room lamp table is an adaptation of the Chinese-Chippendale style and follows the simpler style of that famous designer.

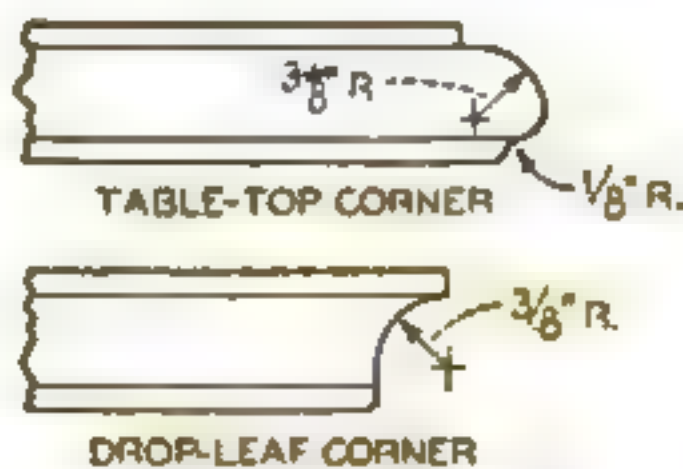
The material should be in keeping with the existing furnishings in the room, but mahogany is preferred since most of Chippendale's creations were executed in mahogany. If mahogany is selected, be sure to get the best grades. Although the table may be constructed without power-driven tools, a circular saw and shaper make the task easier. A drill press with a spindle speed in excess of 5,000 r.p.m. can be used for the shaper operations. A jointer, if available, will eliminate the hand planing operations.

Frame. Prepare legs with sides square and absolutely uniform as any difference will cause the molded edge to vary. Mortise in drill press, using a $\frac{3}{8}$ " router bit or the regulation mortising attachments. Shape corner edges. The writer used a so-called

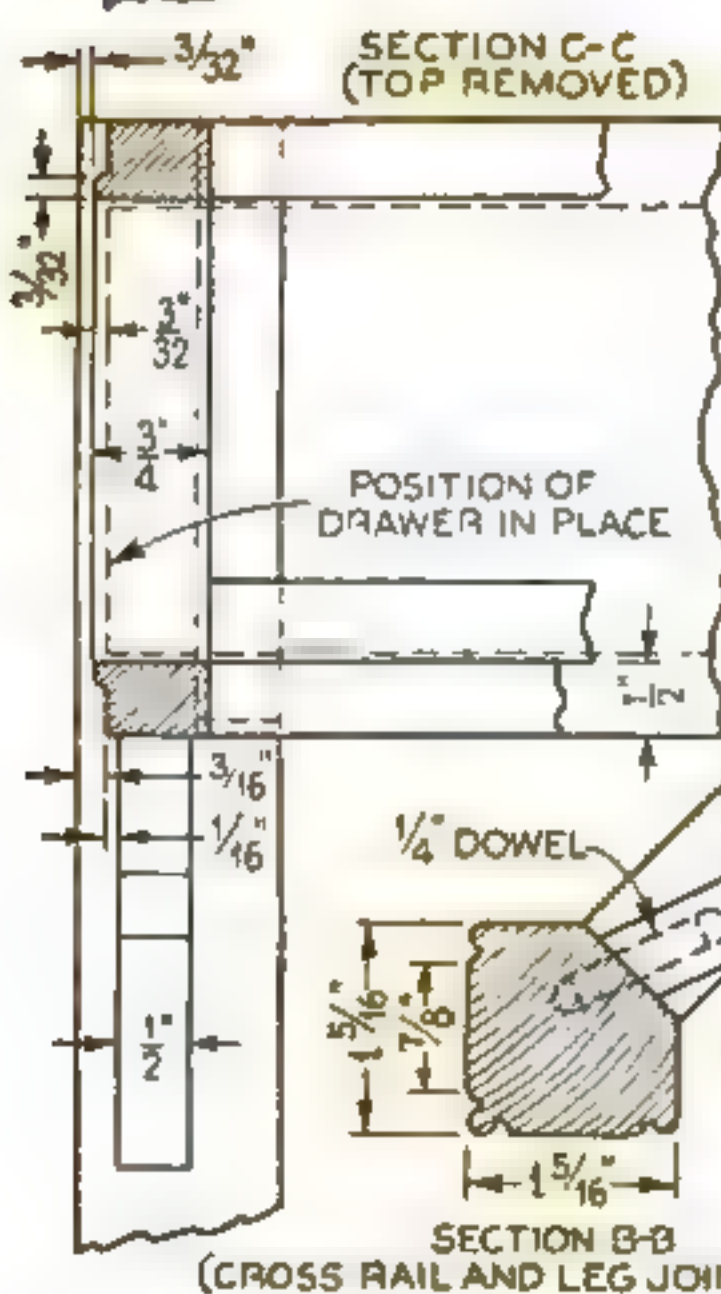


TOP VIEW

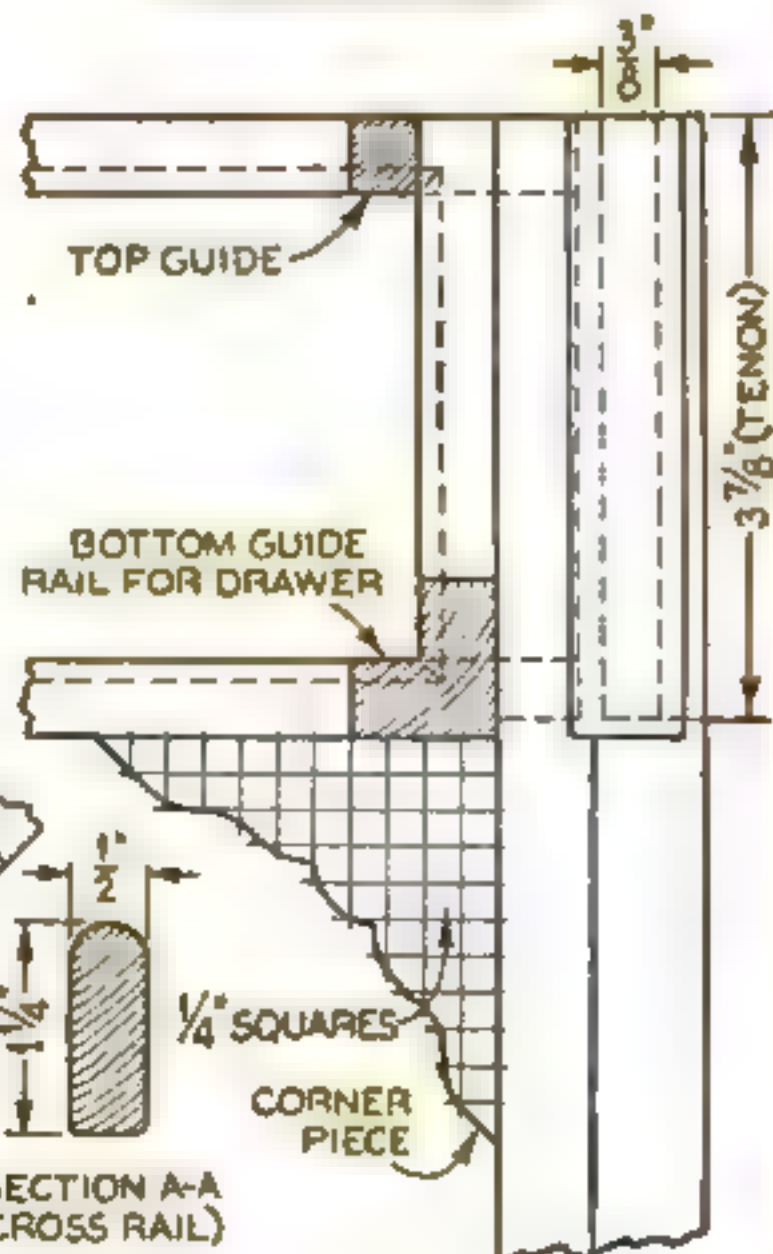
Constructional Details



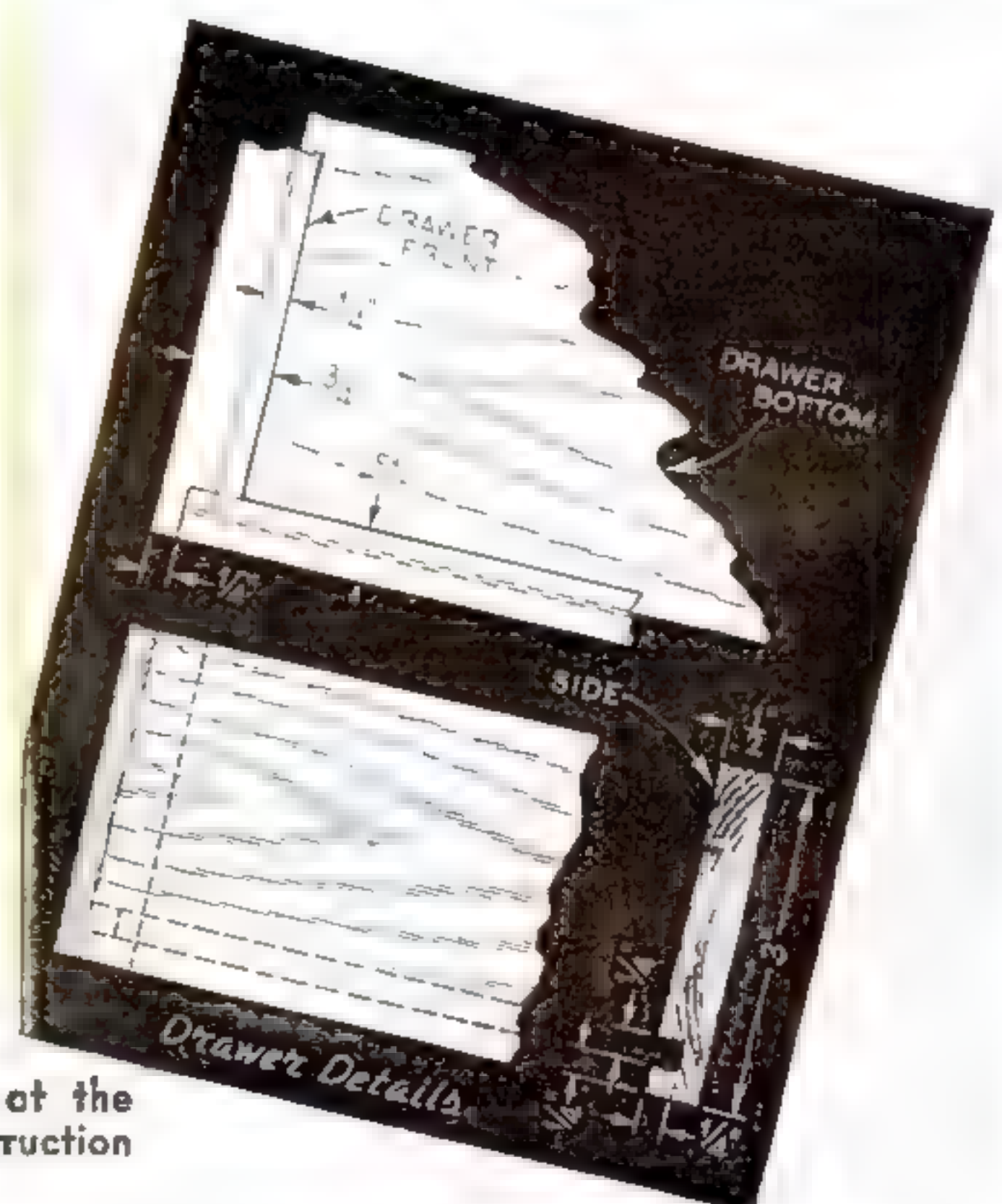
DROP-LEAF CORNER



SECTION B-B (CROSS RAIL AND LEG JOINT)



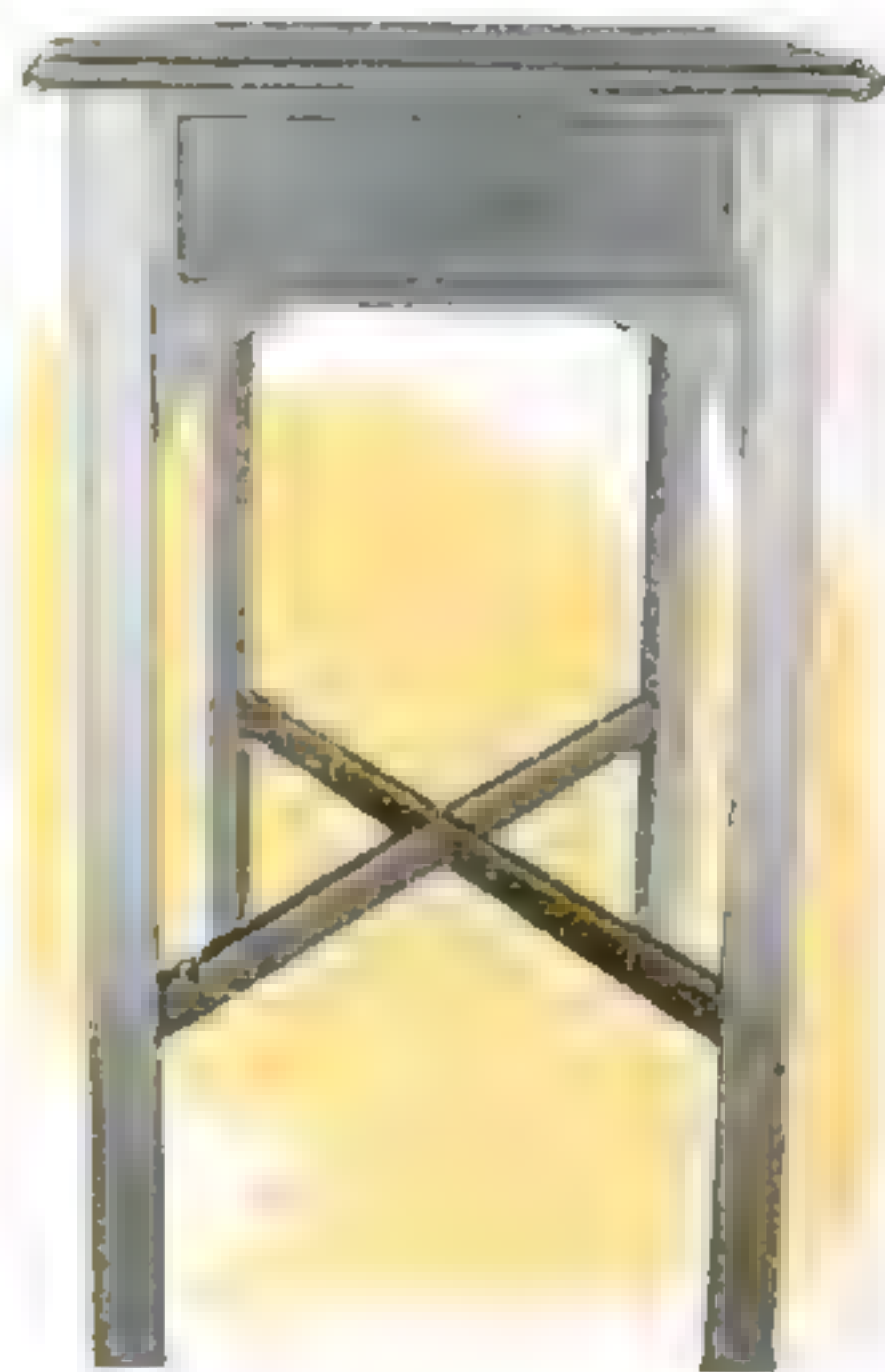
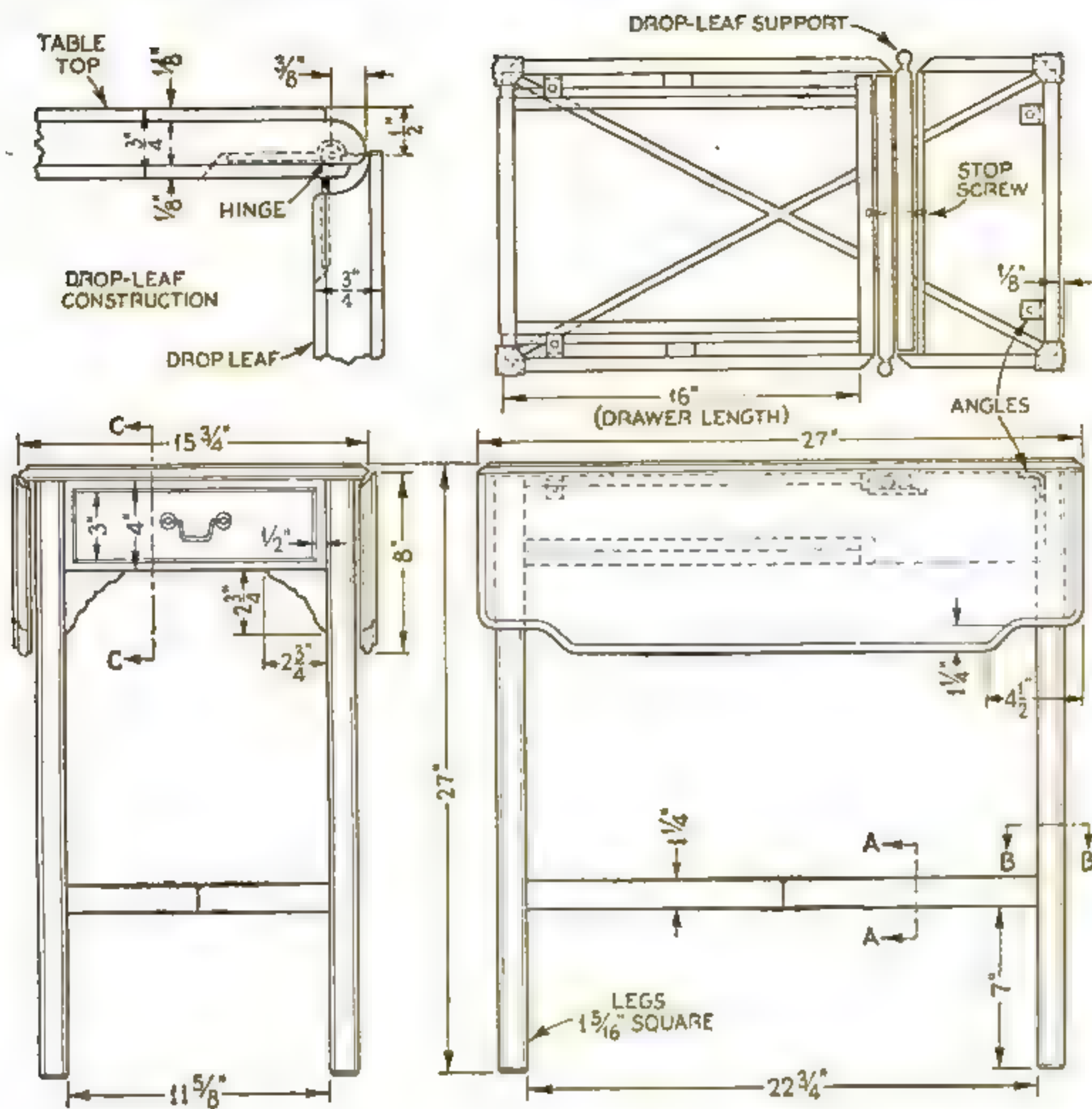
SECTION A-A (CROSS RAIL)



How the framework is put together; cross sections taken at the points lettered on the assembly drawings; and drawer construction

By J. L. BIRD

Left, assembly drawings, one with top removed for clearness, and a detail of rule joint. The finished table appears at bottom



D-40 shaper cutter. Bevel the inside of each leg.

Cut side rails and tenon them on circular saw. A $\frac{3}{32}$ " beading is called for on all four pieces around the drawer. This may be made with the same shaper cutter. When joining the beading at corners, a 45-deg. bevel joint should be used, although the pieces themselves are butt joined. All pieces are tenoned to the respective legs.

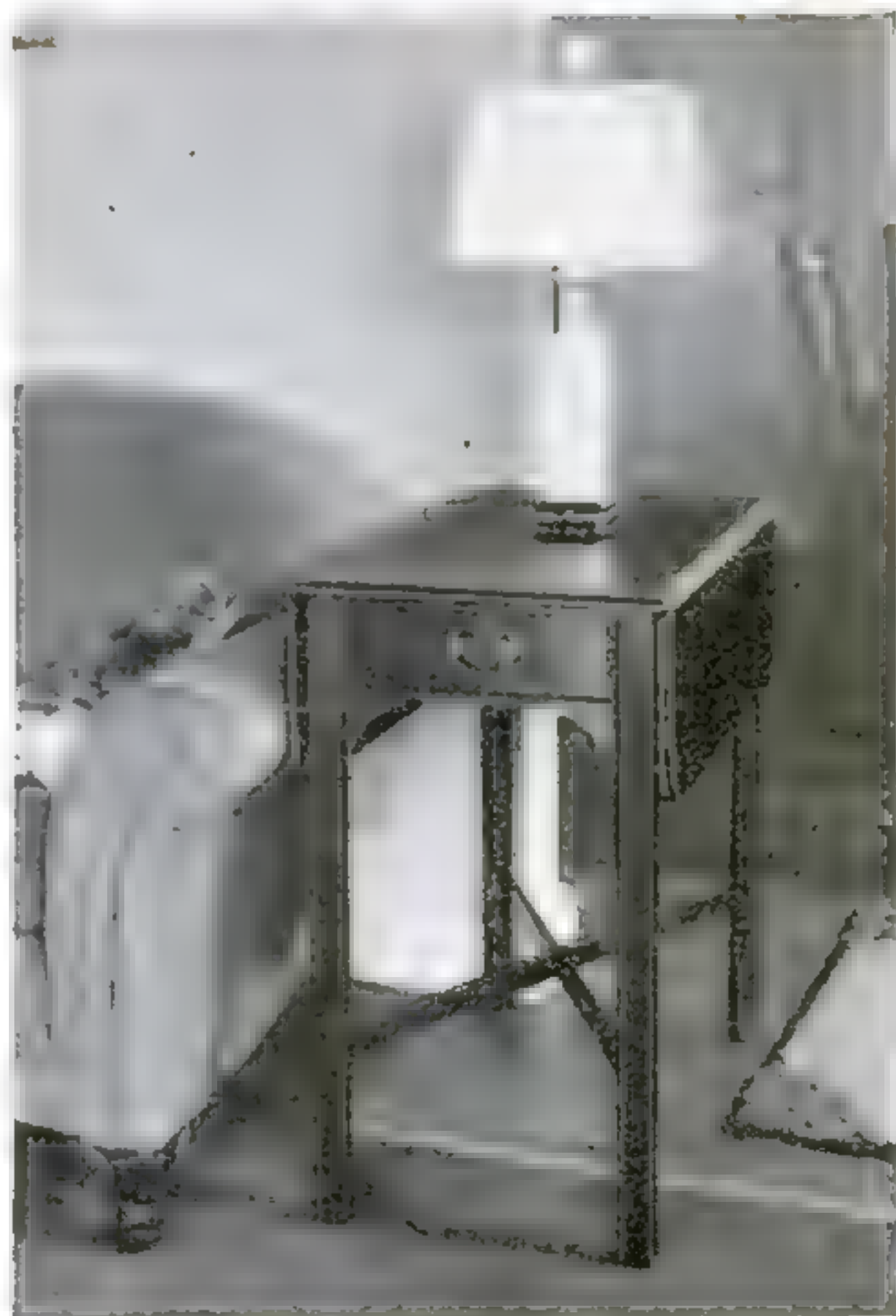
Glue front and back pairs of legs together with their respective short end rails. A cold-water (casein) glue is easy to mix and use.

Prepare the bottom cross members. Take care to cut the proper angle on the ends to fit on bevel sides of the legs. The cross is made with a half-lap joint. When all parts fit, glue and clamp them.

The drop leaves are held horizontal by slide bars. Glue a channel-shaped cross member between the side rails at the end of the drawer travel. The slide bars are made of $\frac{3}{4}$ " square stock with rounded ends. Cut an opening in each side rail for the bar to slide to the extended position. If the sides of these openings are cut at approximately 45-deg. angles, the bars may be grasped with ease when it is desired to raise the drops. Fasten a screw into each bar to stop against the side rail as shown.

Top and drawer. Prepare top and drop leaves. Cut molded edges (cutters D-102, D-101, D-63, and D-51 were used by the writer). The rounded corners on each leaf are molded by means of depth collars on the shaper spindle.

Although the drawer corner joints may be



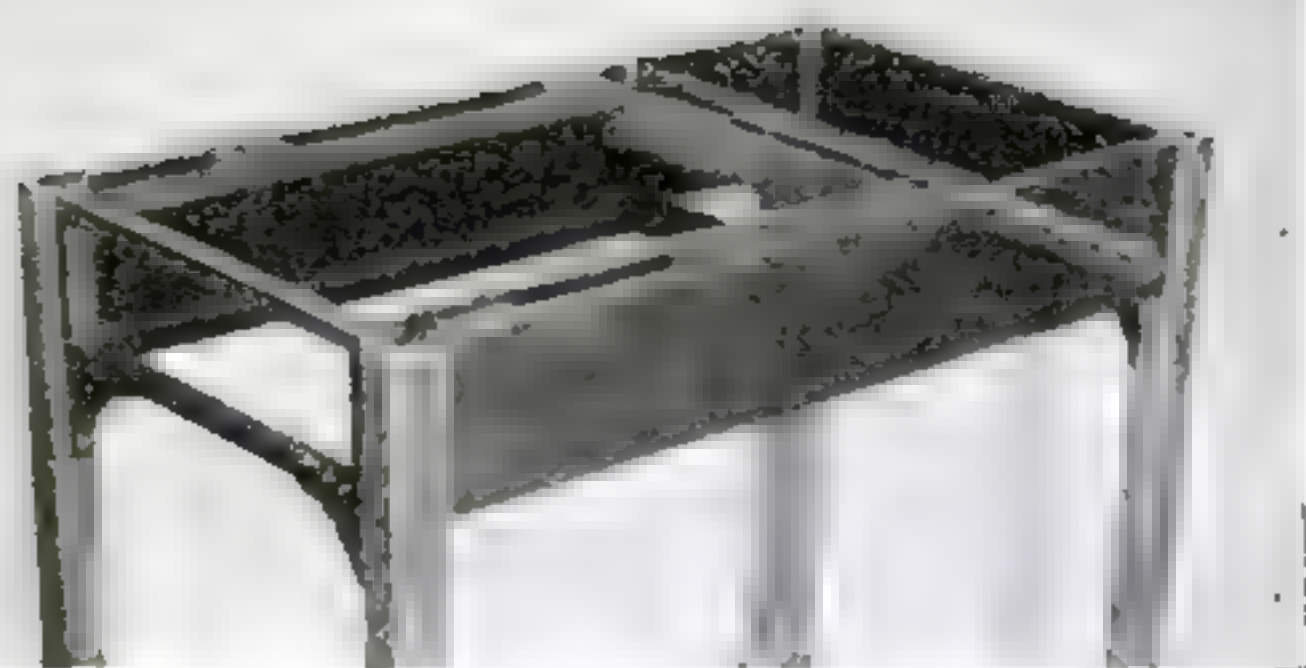
dovetailed, the plans show a simple butt joint. Ends and sidepieces are grooved to take the drawer bottom.

Make the four angle pieces as shown and glue into place $\frac{1}{16}$ " inside the rails.

Sand all exposed surfaces to the approximate finished smoothness before gluing. Wipe all glue joints clean of excess glue with a wet cloth.

Fit hinges, which must be let in. Note shape of hinge. Take an ordinary hinge, clamp in a vise, and strike the joint a sharp blow so one side will have its mounting surface in line with the center of the hinge pin. This side attaches to the top. After fitting, remove the hinges. Do not fasten the table top until all finishing has been completed.

Finishing. Use water stain, thin seal coat, paste filler, and three coats spar varnish, sanded between coats and finally rubbed with pumice and rottenstone*.



The frame before the top and drawer are added. A slide bar is used to hold each drop leaf horizontal

Apply the hinges and fasten top with small angles set so that their top surfaces are below the rails about $\frac{1}{16}$ " to insure tight joints.

*For detailed instructions in regard to finishing fine furniture and woodwork, see the chapter "Painting and Finishing" in *Amateur Craftsman's Cyclopaedia* (Popular Science Publishing Co., Inc., New York, price \$3.50).

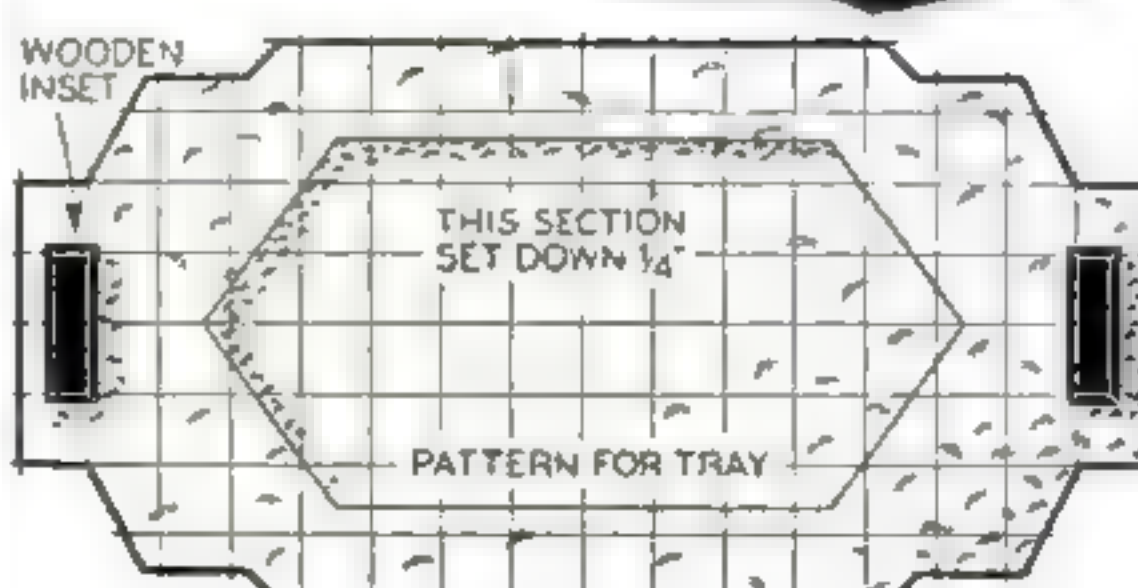
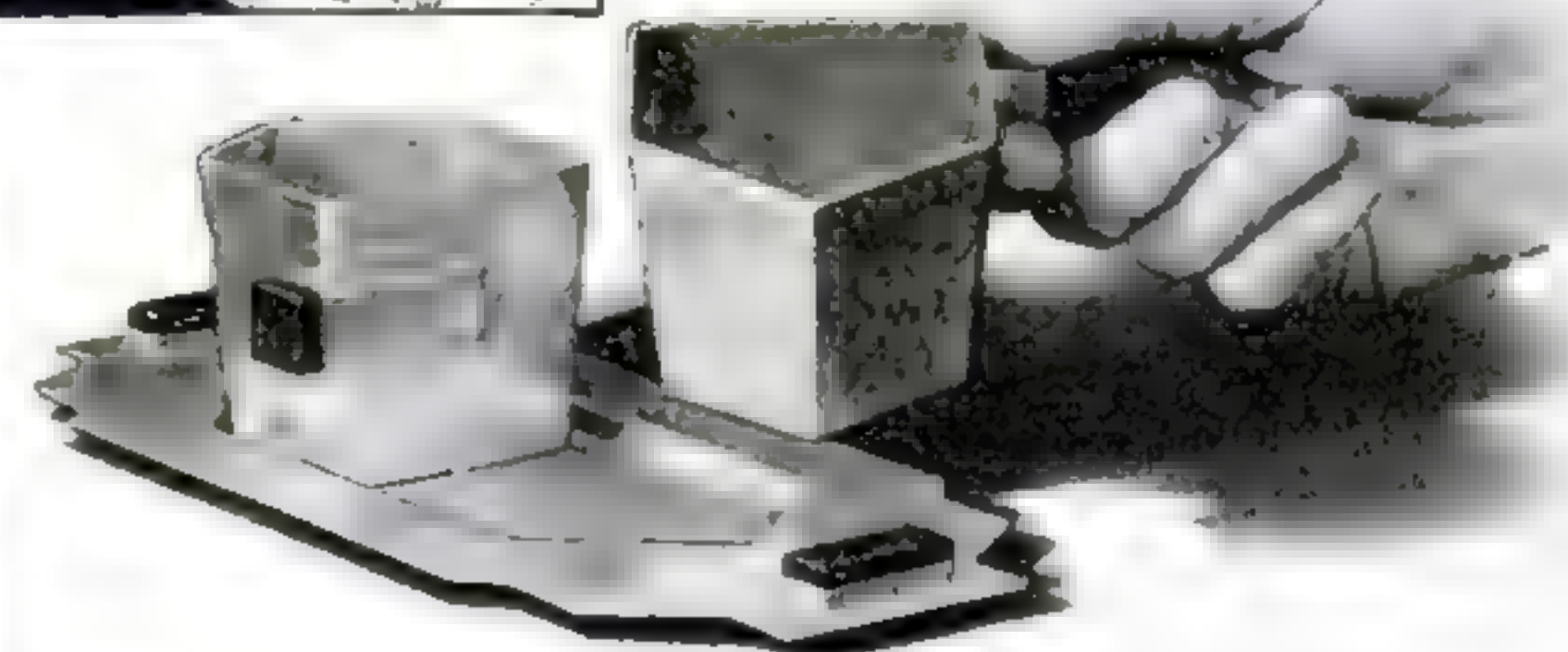
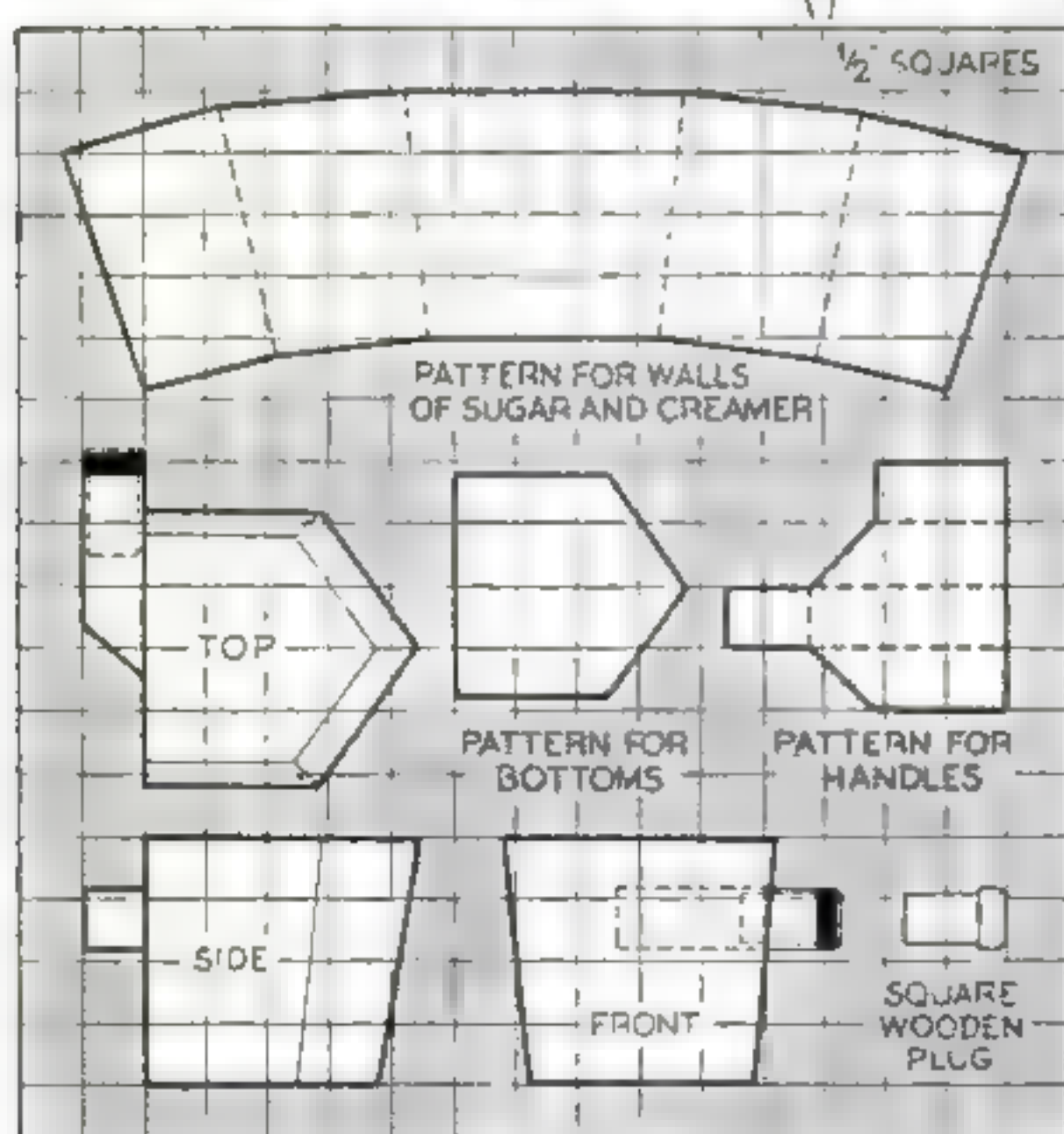
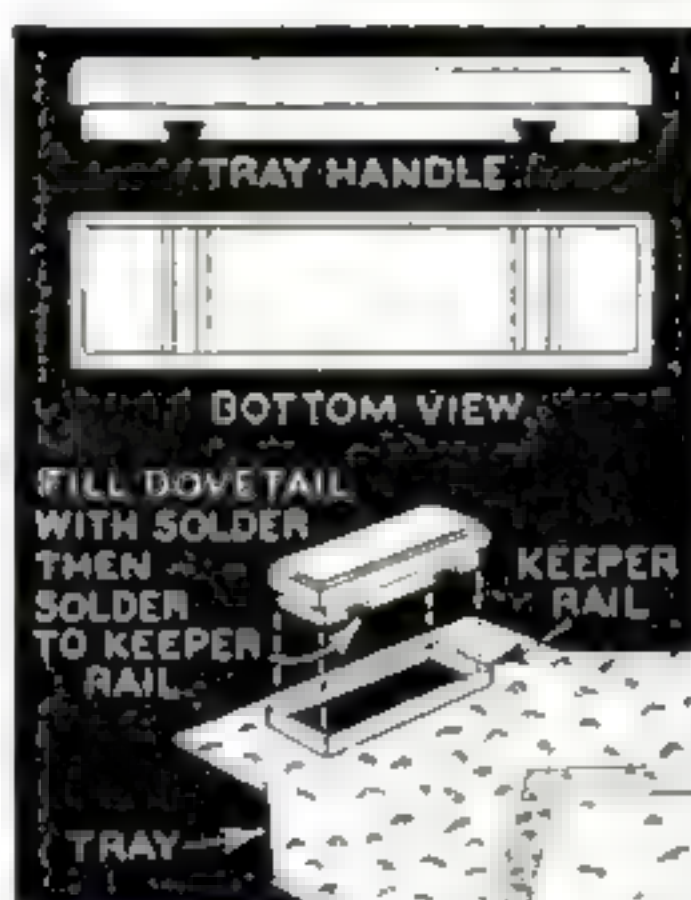
A Sugar-and-Cream Set of Hammered Pewter

MODERN in design and comparatively easy to make, this sugar-and-cream set provides a decorative combination of wood and metal. The pieces illustrated are of hammered pewter, No. 18 gauge, with black ebony inserted in the handles, although other woods and metals might be used.

The metal sockets that form the handles were made by bending the metal around a hardwood form. These were soldered in place, after which the open ends were each filled with a carefully shaped ebony plug. The wooden plugs on the tray handles, being rather short, were secured in the sockets by

cutting a dovetail notch in the lower end of the plug and filling it with solder, which was attached in turn to the metal. Glue was used to hold the wood in the longer handles.

Note that the center of the tray is set down $\frac{1}{4}$ " to hold the two cups or containers in position.—CHARLES M. RICE.



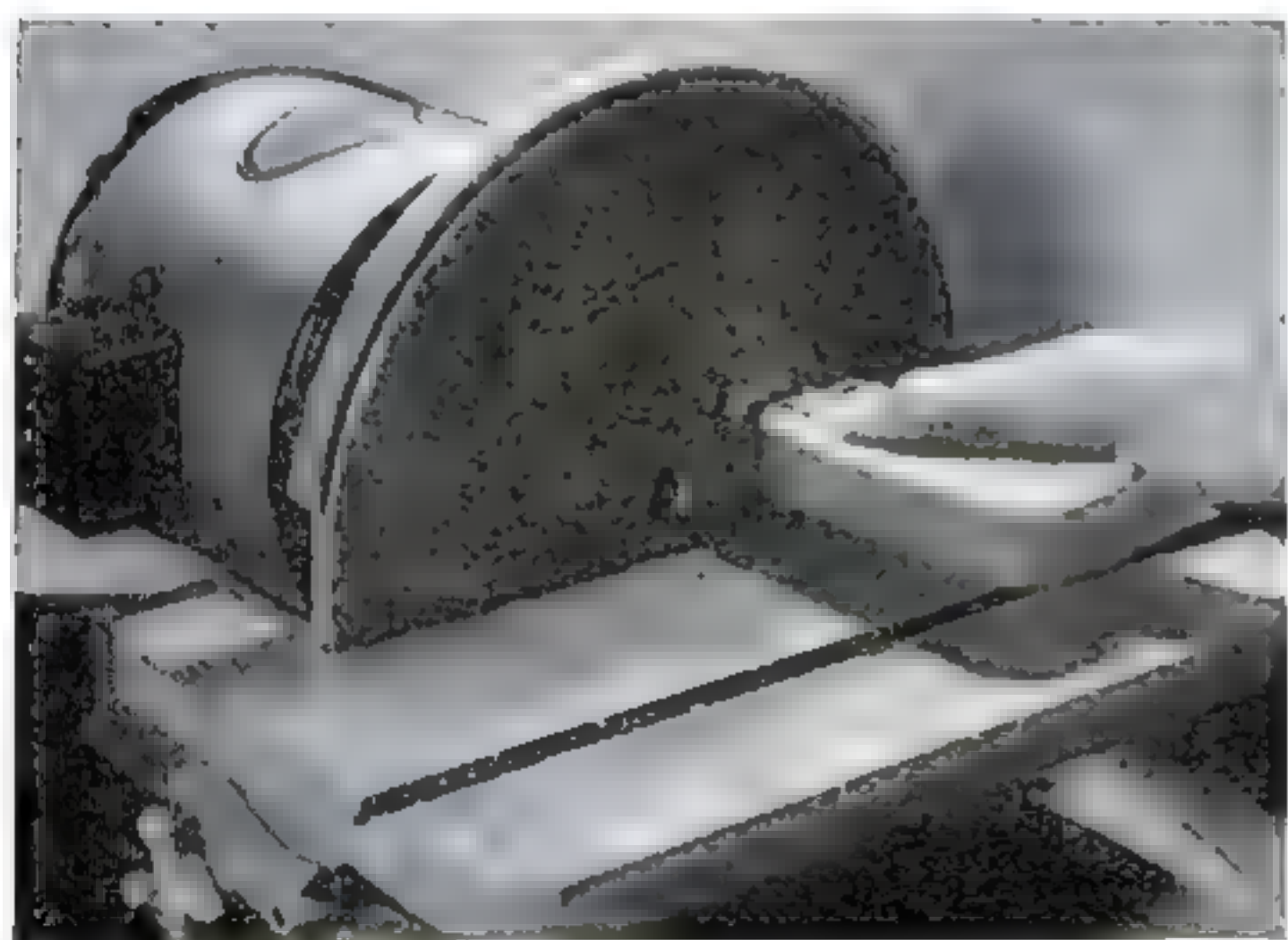
Patterns for cutting and bending the metal parts: a detail drawing of the tray handles; and a photo of the whole set

Sand Blown on Paint Gives Volcanic-Rock Effect



Originally painted a flat ivory, the area around this fireplace was given a stratified lava-rock appearance by blowing sand on wet paint as at right

A PLASTER or stucco-finished fireplace of the type illustrated may be given the appearance of volcanic rock or rare pumice-stone masonry by painting it a flat ivory or light gray tint and blowing dry sand from a sheet of cardboard over the wet paint to form the desired pattern. It is best to make light tracings with an awl on the fresh paint to act as a rough guide in applying the sand. After the paint is dry, a soft brush is passed over the sand to remove the loose grains and give a blended, softened effect. If a pattern does not turn out satisfactorily, simply paint over the sand and try another design.—HI SIBLEY.

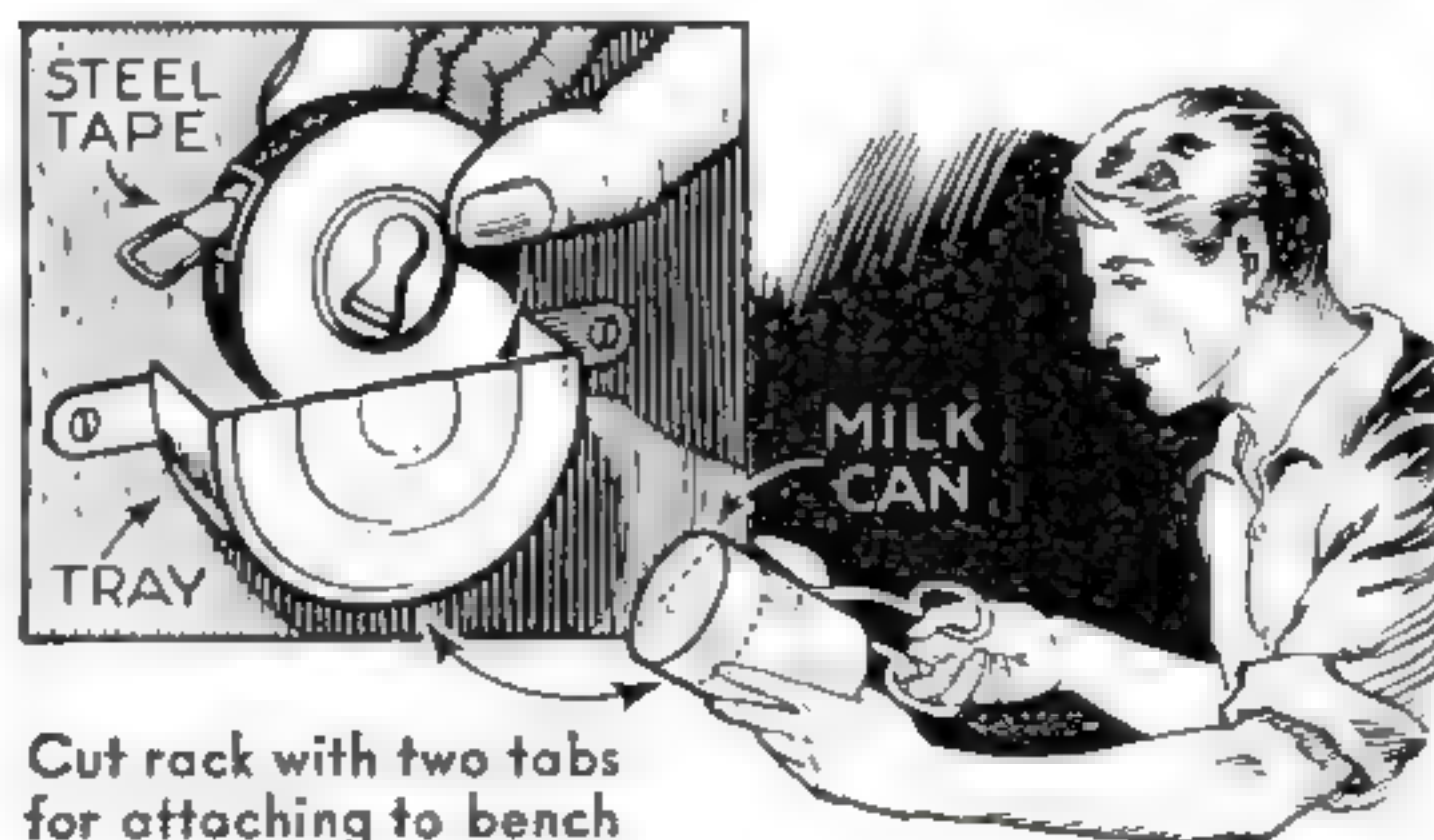


Soap Holds Sandpaper on Disk

CHEAP laundry soap is a satisfactory adhesive for attaching sanding disks. It is stickier than more expensive soap. Coat the sanding wheel either by rubbing the cake against the metal or holding it against the wheel as it revolves.—K. L. ROBBINS.

Tray for Tape Cut from a Can

A STEEL tape is less likely to be mislaid or to become damaged while knocking around on the bench if a holder is made as shown below from the bottom part of a large condensed-milk can. Cut it off to make a tray about 1" deep with two tabs, which are screwed to the tool rack at the back of the bench, or to any other place that is convenient.—GLEN F. STILLWELL.

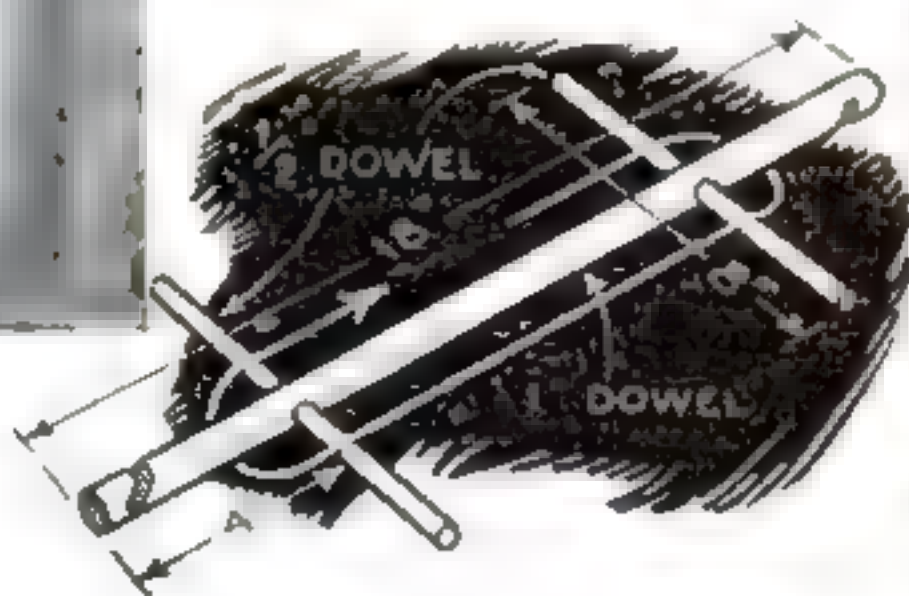


Clothesline Coiled Speedily



Made from dowels as at right, this winder holds a hundred feet of line

THIS clothesline winder, made from dowels, is easier and speedier to use than most devices for the purpose. It also allows the line to dry rapidly. If made the size shown, it will hold a hundred feet of line without crowding. The line is wrapped around as shown by the arrow or crossed in front, as preferred.—THOMAS W. BENSON.

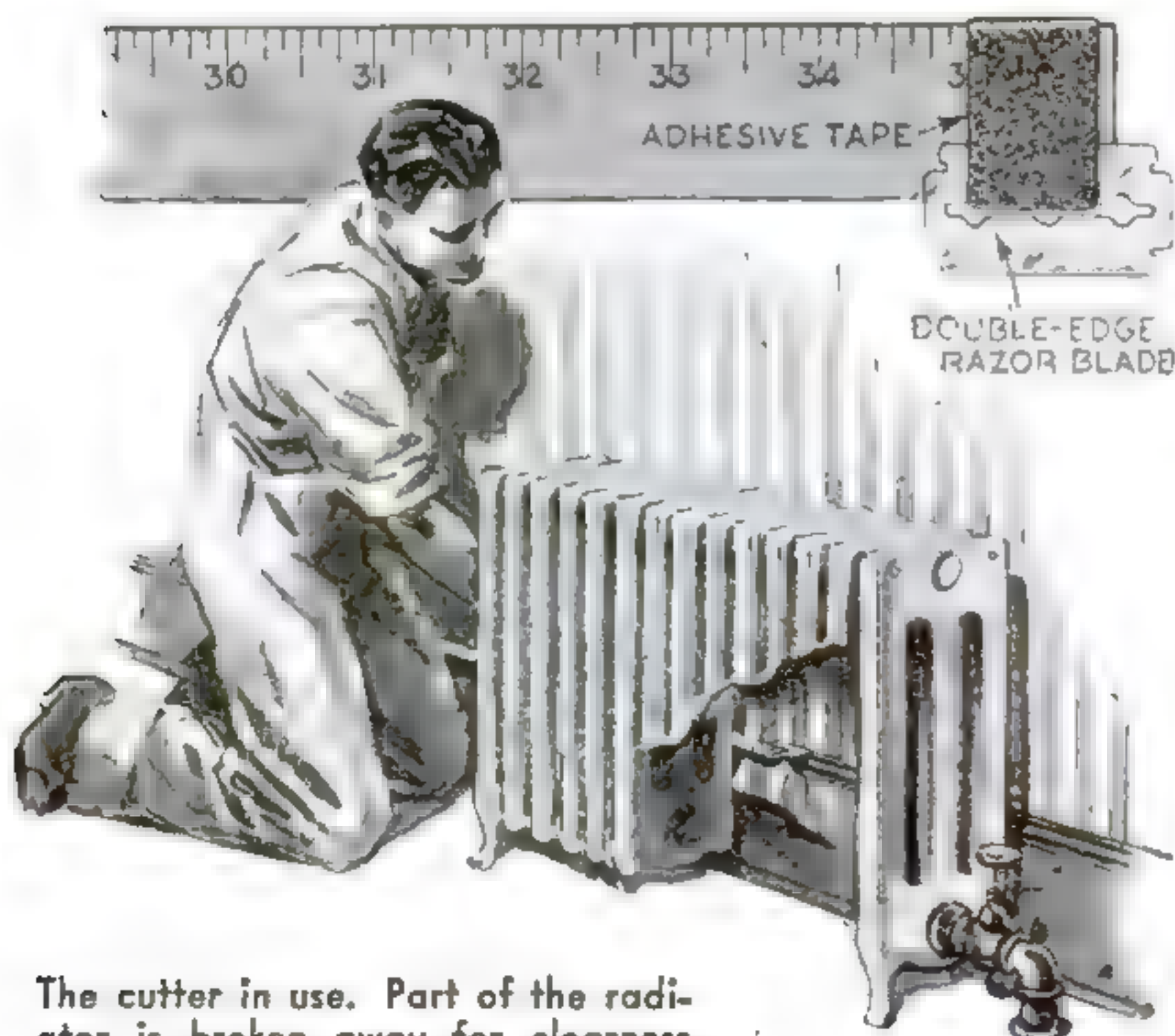


Bottle Stoppers Used as Handles for Files

RATHER than use small files and similar tools without handles, as is often done, it is better to push the ends into rubber stoppers from washing-fluid bottles. Such handles cost nothing and can be removed instantly when desired. Make a small hole to start the end of the file into the stopper. A simple rack from which to suspend the files may easily be made from scrap lumber.—MERLE TERRILL.

Trimming Paper Behind a Radiator

IN APPLYING wall paper behind a radiator set close to the wall, first smooth out the paper with the flat side of a yardstick, then trim it with a double-edge razor blade fastened to the yardstick as shown. If there is a picture molding, the paper may be cut off along it without leaving a rough edge by using a similar type of trimmer, made with a shorter stick.—HARRY S. GOODSON.



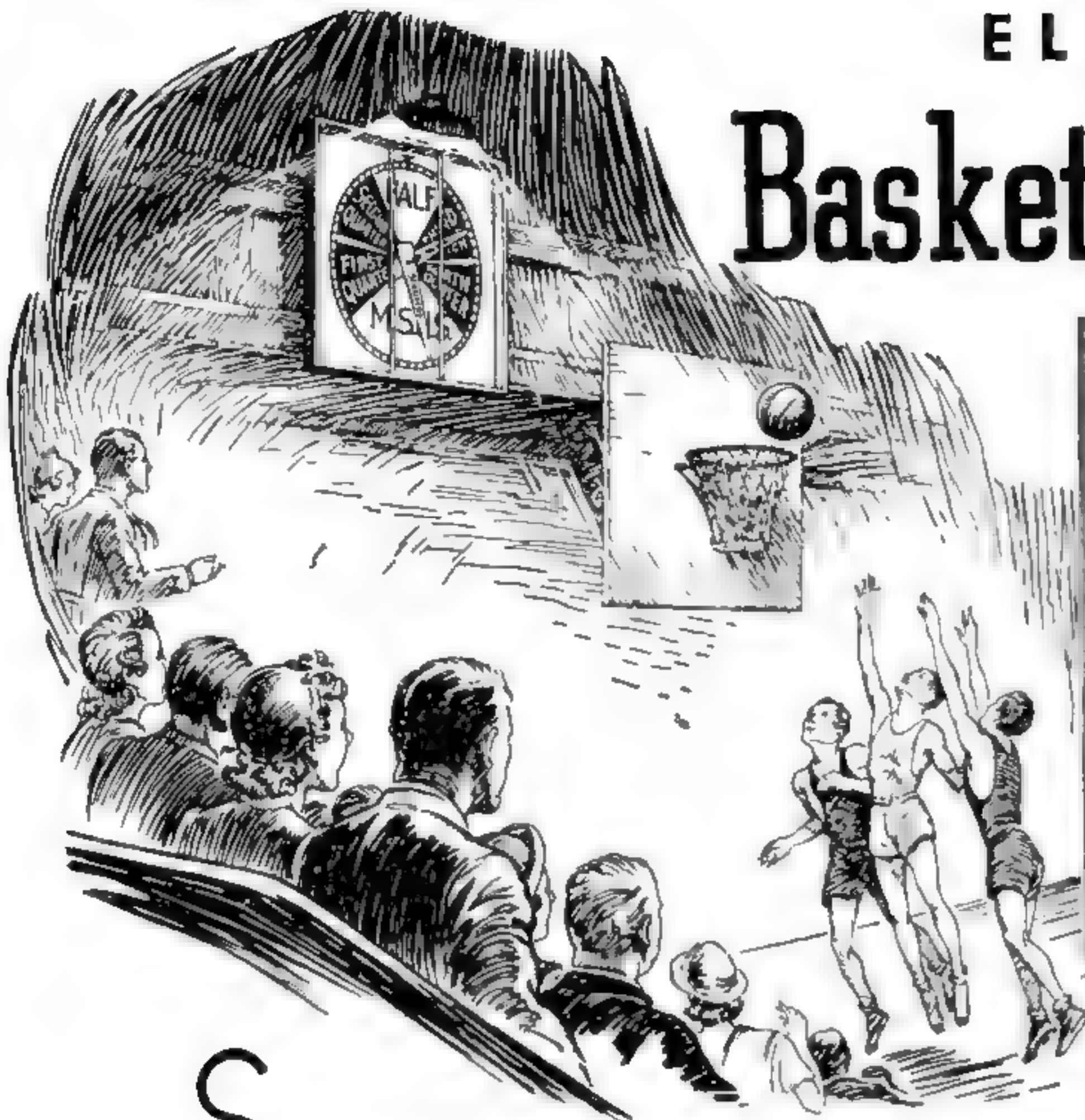
The cutter in use. Part of the radiator is broken away for clearness



Two Ways for Improving Paintbrush Keepers

THE rod on which paint or varnish brushes are suspended in a liquid keeper between coats can be improved by bending a hook in one end as shown so that it will not slip off and fall into the can. Another larger can, slotted to pass over the straight end of the brush wires, may be placed over the brushes to keep out dust. The slot should be cut about halfway down the can.—BROOKS HILL.

ELECTRIC Basketball Timer



To protect the timer, a frame is added around the edge and bars fastened across the face

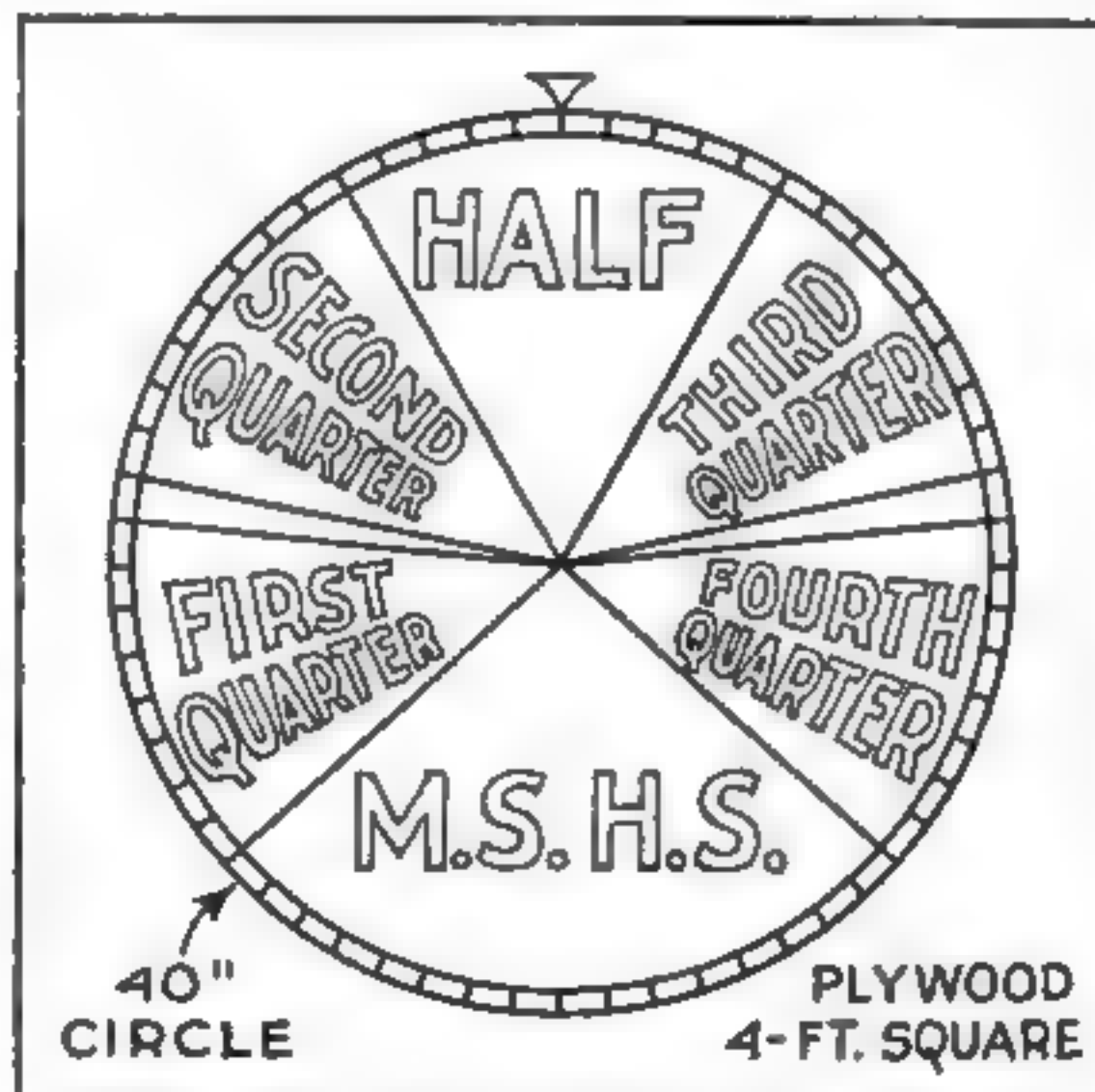
SPECTATORS' interest in a basketball game is increased by knowing exactly how much time in each quarter remains to be played. This is possible if a large timer is made.

A heavy, well-made, self-starting electric alarm clock, with a sweep second hand, is used as the source of power. First remove and discard from the clock the face, hands, and alarm mechanism. Next, the shafts of the minute hand and second hand are extended by soldering a piece of copper tubing on each as shown. Thread the tubing so that the new hands may be bolted on. The hands are cut either from sheet aluminum or cardboard. Each hand must be balanced about the axis by adding lead weights to the short end.

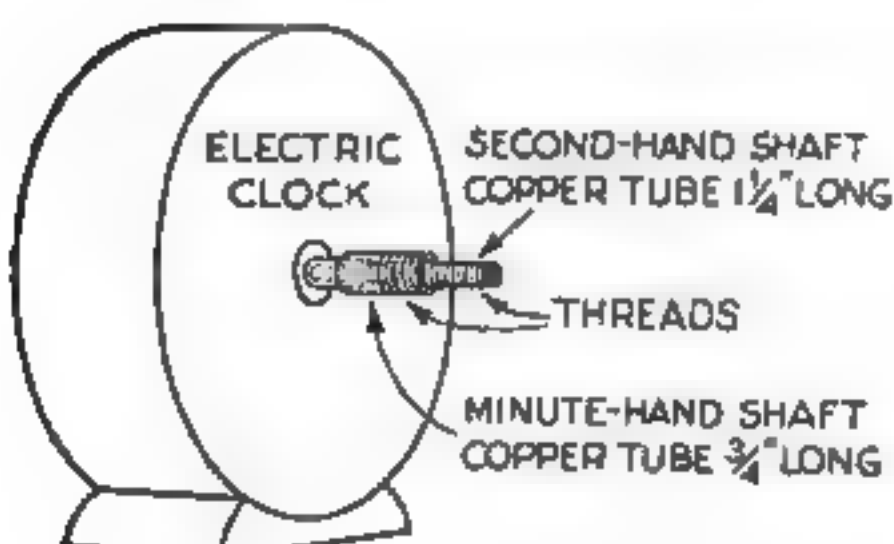
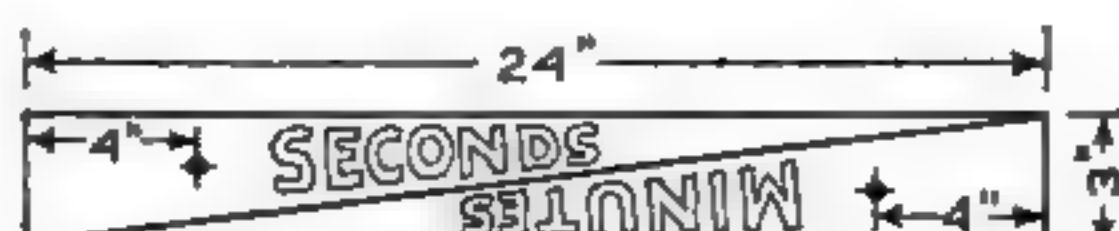
The face of the timer is

made from a 4' by 4' piece of plywood, painted as illustrated. Be sure to use a flat finish to reduce reflection. The school colors may be employed if they give sufficient contrast. Bore a $\frac{1}{2}$ " hole in the center of the face and bolt the clock on the back, allowing the extended shafts to protrude through this hole. Lock each hand in place with a nut on both sides. In use, the second hand starts at the top of the dial where the arrow is painted.

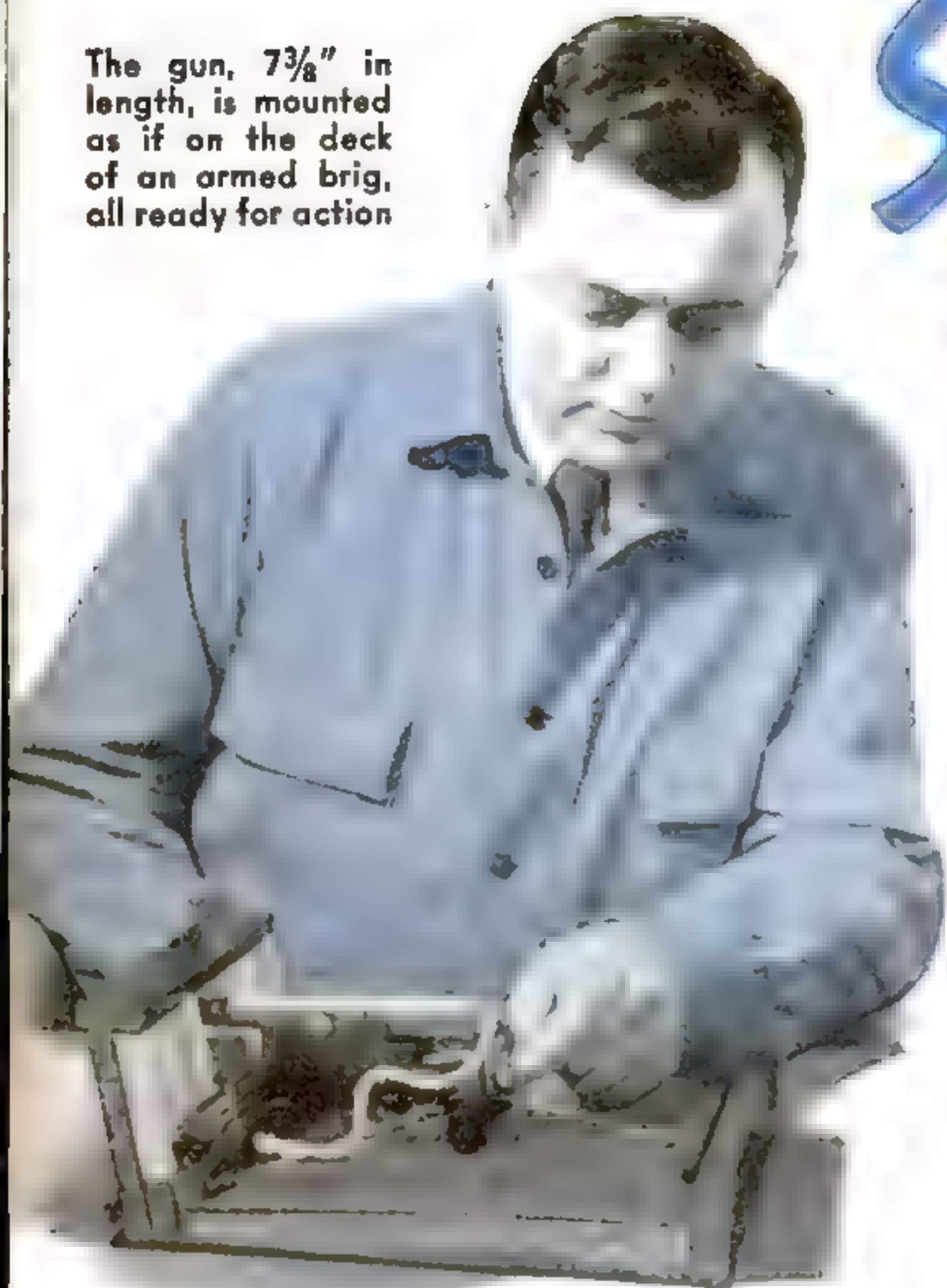
For protection, a frame of 1" by 4" wood is added around the outer edge, and two iron bars are fastened across the middle of the face. When the timer is finished, fasten it securely to the wall in a position visible to both the audience and timekeeper, and where it can be reached for resetting. The 110-volt wires are run around the gymnasium to the switch on the timekeeper's table and then to an electric outlet. In this connection, it is important to observe the precautions mentioned in last month's article about an electric score board. (P.S.M., Oct. '38, p. 184).
—WILLIAM A. HARRIMAN.



Above and below, patterns for face and hands. At left, method of extending shafts of clock through hole in plywood



The gun, $7\frac{3}{8}$ " in length, is mounted as if on the deck of an armed brig, all ready for action



SIX-POUNDER in Battery

HOW TO BUILD A SCALE MODEL OF A PICTURESQUE OLD-TIME CANNON USED ON MANY SMALL SAILING SHIPS

By
John F. Hinternhoff

ABOARD small ships from the time of the Revolution through the War of 1812, a favored arm was the six-pounder. This model represents one of these guns in battery on a section of the deck of a 90' brig of about 1798, built on a scale of 1" equals 1'.

First, the gun. Although it may be made of wood, it really should be cast in bronze (an 85 percent copper alloy is about right). If you are not equipped to do the work yourself and there is no foundry nearby, the local

machine or auto repair shop can send the pattern out for you. To get a casting $7\frac{3}{8}$ " long, the pattern should be turned $7\frac{1}{2}$ " long and a slight allowance be made for shrinkage in diameter.

For the bore, drill a $\frac{5}{16}$ " hole 3" deep. Another $\frac{5}{16}$ " hole is drilled for the trunnions, and a $\frac{5}{16}$ " round by $1\frac{7}{8}$ " brass rod pushed through. The breeching loop is a piece of $\frac{1}{16}$ " brass wire set in holes in breech and cascabel knob. Make the touchhole with a No. 60 drill.

The casting should be filed and rubbed with emery cloth, but not made slick. Small casting blemishes are desirable since all old guns had them. To give an antique patina of gray-green mottled with green, I immersed the gun, with trunnions and breeching loop in place, for two hours in the following solution: $\frac{3}{4}$ oz. crystallized iron chloride, 4 oz. ammonium chloride, 2 oz. verdigris (copper acetate), 1 oz. cream of tartar (potassium bitartrate), and $2\frac{1}{2}$ oz. common salt (sodium chloride) dissolved in 1 qt. of water. Take the piece carefully from the bath, let it dry thoroughly, remove the dust, but do not use an abrasive.

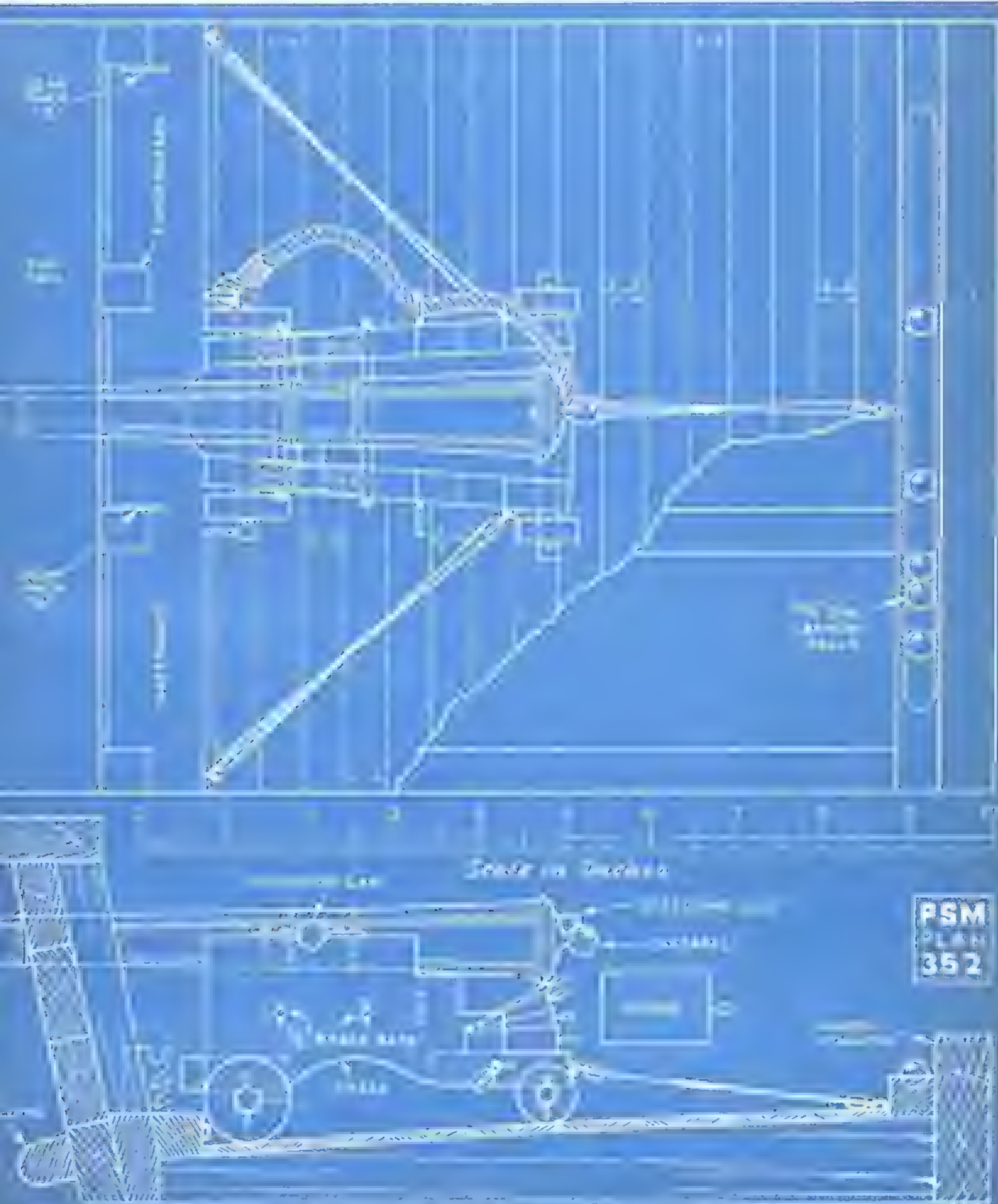
Leave some extra wood at the tops of the cheeks

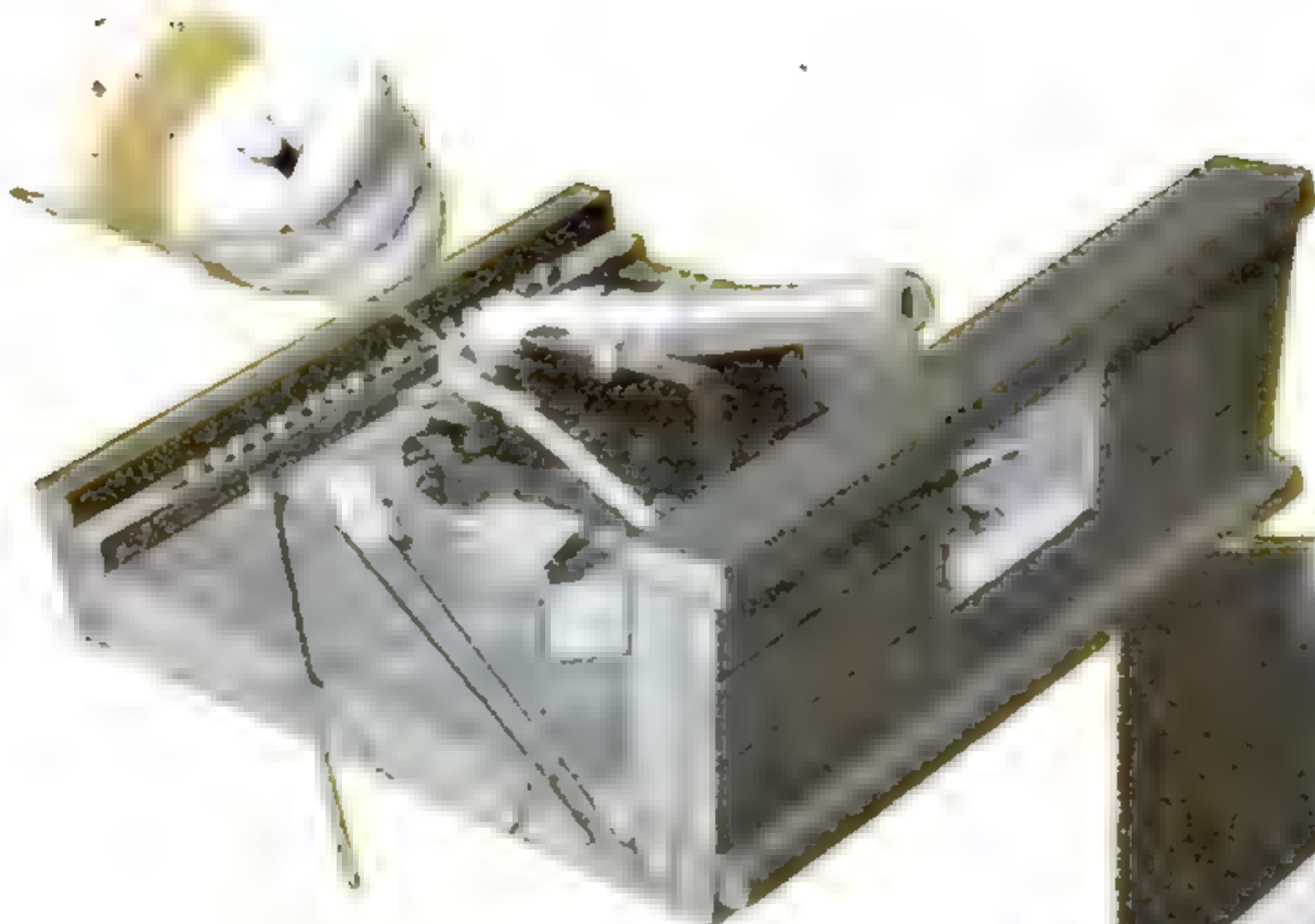


so that the rests for the trunnions can be drilled $\frac{3}{8}$ ". Trunnion plates and caps are made from tin. If heated red in a gas flame, beaten with a hammer, reheated and plunged into cold water, they will look like wrought iron. The trunnion plate is pushed into the rest and shaped by the trunnion. The cap strip is shaped over the trunnion and both are cut off even; two holes are drilled in each extension, and $\frac{3}{8}$ " brads driven through. Other details of the carriage are shown in

the drawings. Several quoins or wedges should be made and stained brown. The remainder of the carriage is black.

The deck beams are curved for the camber of the deck, and the bulwarks flare outward. I used mahogany strips for the deck. If cut from one piece, they should be shuffled to make the planks contrast. A slight variation in width is realistic. The last narrow plank must be laid at the outer edge of the deck. A good way to fasten them is with liquid glue





The sides of the deck beams are hacked with a deep-set plane to represent adz marks, and end grain is left to look like a section cut from the ship

Below, the cannon-ball groove is easily shaped if the strip of wood is first cut in two lengthwise, then sanded after the halves have been assembled



and pegs. At intervals use $\frac{3}{8}$ " brads where plank endings are simulated.

Cannon balls ($\frac{5}{16}$ " bearings) can be obtained at a bicycle shop. If new and silvery, wet them with salt water and expose for a day or two. The groove for the balls should be closer to the coaming.

For the sponge I used sheepskin from an old shoe buffer. The rammer is a piece of wood whittled down to $\frac{5}{16}$ " round with a hole to take the staff. The worm staff is stouter than the others ($\frac{3}{16}$ ") and has a crossbar to give leverage. The worm is a piece of fine spring steel. Note that the tool resembles parallel corkscrews



Beams, bulwarks, waterways, and hatch coaming before deck is laid

which are coiled like lefthand threads. The racks are cut from fiber board and nailed to timberheads.

The bulwarks outboard, the cap rail, and

LIST OF MATERIALS FOR SIX-POUNDER MODEL

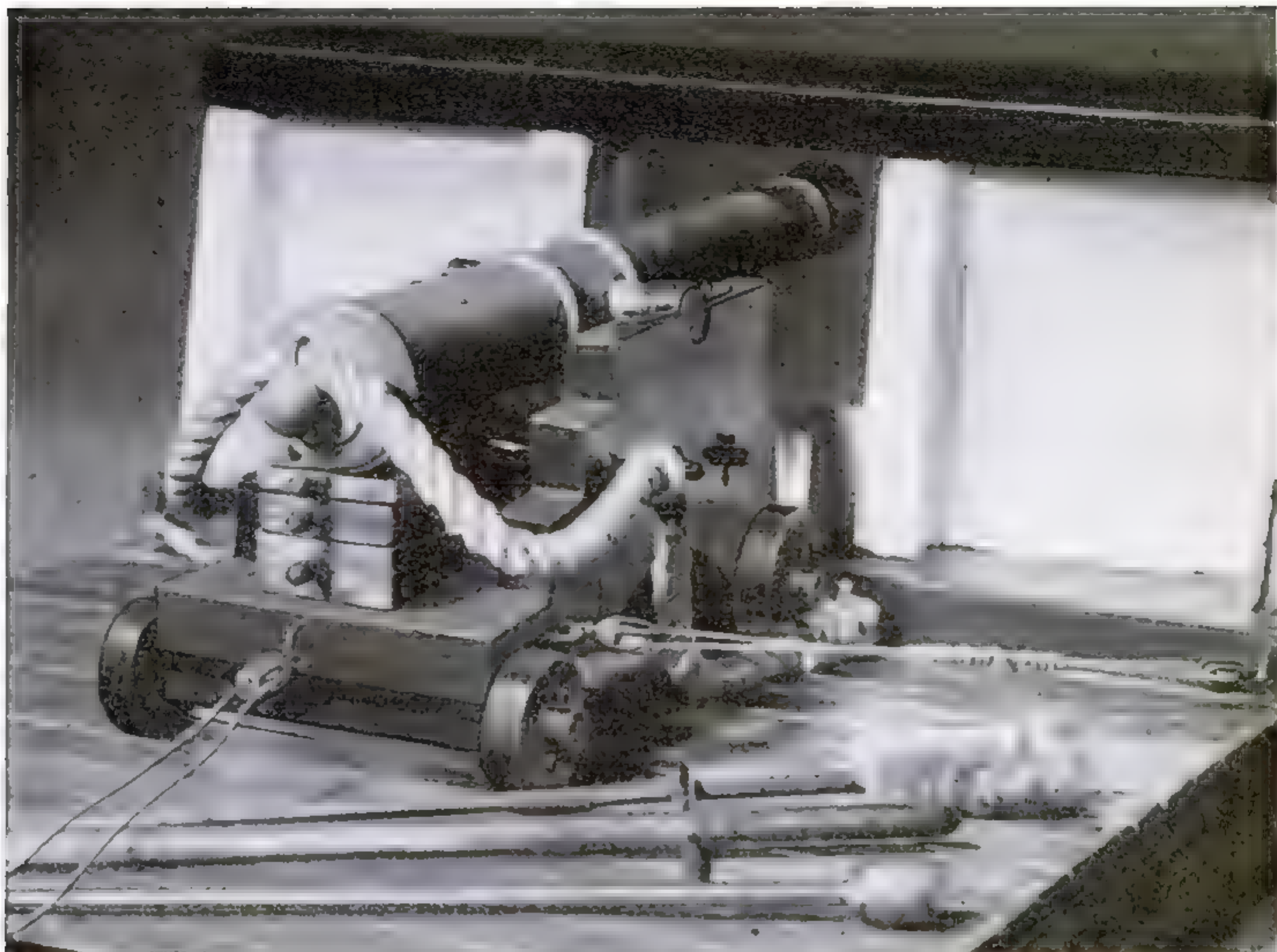
No. Pc.	For	L.	W.	T.
1	Pattern	9	1 $\frac{1}{4}$	round
1	Hatch coaming	9	2	$\frac{5}{8}$
1	Trough	9	$\frac{1}{2}$	$\frac{1}{2}$
1	Waterways	9	1 $\frac{1}{8}$	$\frac{5}{8}$
1	Cap rail	9	1 $\frac{1}{4}$	$\frac{1}{2}$
1	Molding	9	$\frac{5}{8}$	$\frac{1}{2}$
4	Bulwark wales	9	1	$\frac{1}{2}$
4	Timberheads	4 $\frac{1}{4}$	$\frac{1}{2}$	$\frac{1}{2}$
4	Beams	9 $\frac{1}{4}$	1	$\frac{1}{2}$
1	Axle	3 $\frac{3}{4}$	$\frac{1}{4}$	$\frac{1}{4}$
1	Axle	2 $\frac{7}{8}$	$\frac{1}{4}$	$\frac{1}{4}$
1	Cheeks	4 $\frac{1}{2}$	2	$\frac{3}{8}$
1	Crosspieces	3	1 $\frac{1}{2}$	$\frac{3}{8}$
3	Brace bars and staves	8	$\frac{1}{8}$	round
1	Worm staff	8	3/16	"
17	Deck planks, hardwood	9	$\frac{1}{2}$	$\frac{3}{8}$

No. Pc.	For	L.	W.	T.
1	Blocks, hardwood	2	3/16	$\frac{1}{8}$
1	Wheels, 3-ply	2 $\frac{1}{2}$	2 $\frac{1}{2}$	$\frac{1}{4}$
1	Sheaves, celluloid	1	3/16 round	
1	Racks, fiber	2	$\frac{1}{2}$	1/32

Note: The wood is white pine except where otherwise indicated. All dimensions are given in inches.

MISCELLANEOUS

48" 9-thread linen fishing line for tackles.
1 $\frac{1}{2}$ ' 3-strand rope, $\frac{3}{16}$ " dia. for breeching.
Brass rod, 1 $\frac{1}{2}$ " long, $\frac{5}{16}$ " dia. for trunnions.
4—1" iron brackets for bracing corners under base.
Assorted brads; 4 screw eyes $\frac{3}{16}$ " inside diameter for breeching bolts and rings; 4" thin steel wire; 9" wire 0.030" in diameter; about 20 bearing balls, $\frac{5}{16}$ "; scraps of wood for quoins, piece of fleece, tin from heavy preserve can, glue, etc.



Close-up of the gun and carriage with breeching and tackles. Note the long-handled sponge and rammer

hatch coaming are enameled black; inside the bulwarks and timberheads, white; waterways and molding, dark red. After drying for at least five days, the high gloss should be removed with very fine sandpaper. The ball trough is stained dark and varnished, and the deck is shellacked, sanded, and waxed.

The breeching is made of three-strand rope $3/16$ " thick and the tackles of 9-thread fishing line, both dyed light brown. The breeching is eye-spliced through a $3/16$ " screw eye, passed through the screw eye on the side of the carriage, through the breeching loop, and taken to the other side in the same manner.

Makesix $5/16$ " blocks, three with a loop twisted in the strap to form an eye. The blocks with eyes are hooked to staples in the waterways and the train of the carriage. The tackles are made fast to the eyes with fishermen's bends and rove through the two blocks in each set. Dispose of the falls with a series of clove hitches

around the other parts and trim off the ends.

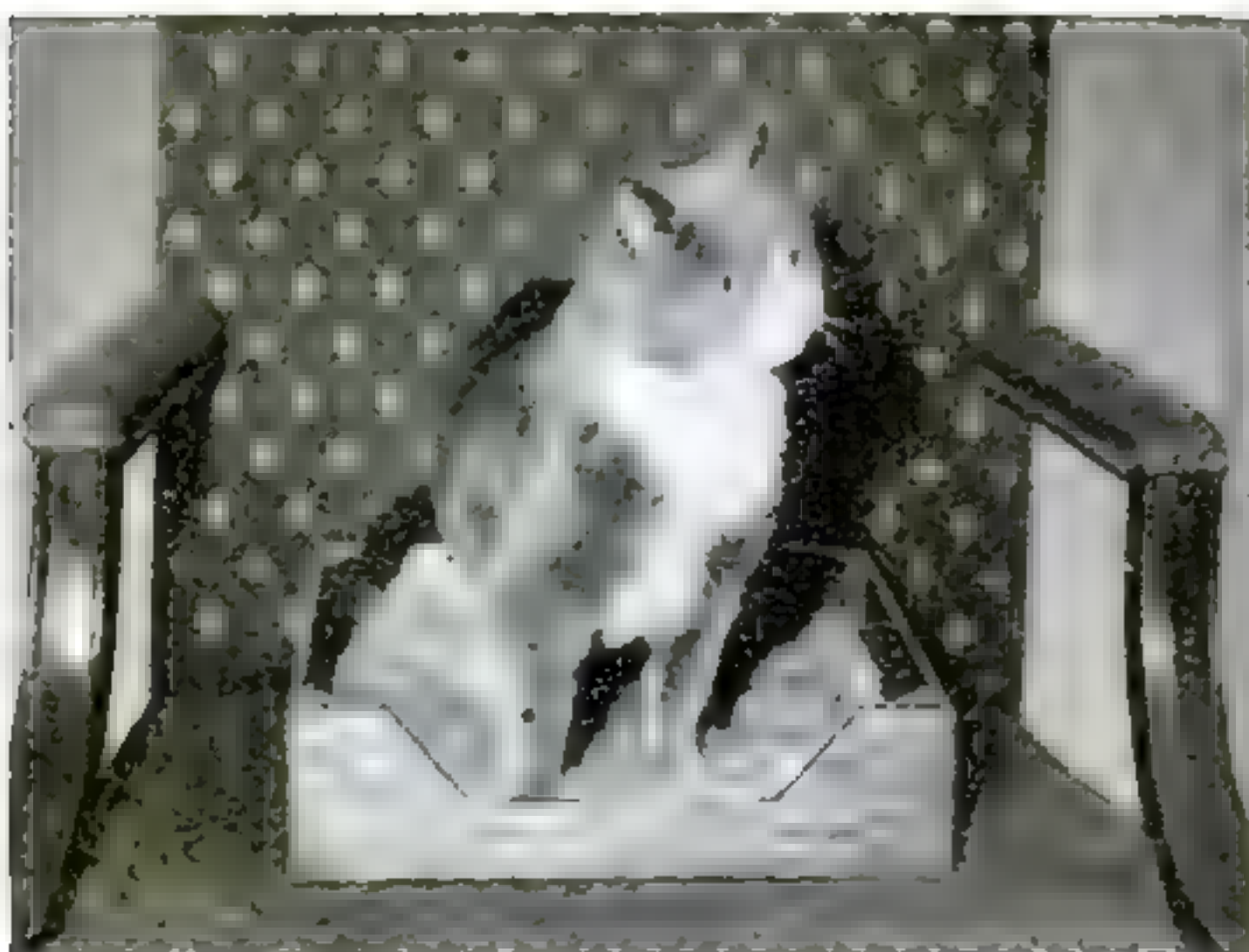
The gun is now ready for action. Stand clear of the breech! Larboard battery Fire!

Hem Opener Aids in Inserting Curtain Rods

FORCING a curtain rod of the type illustrated through the hem of a lace curtain, especially if starched, takes considerable time and patience. It may be done much more quickly by using a hem opener bent from a piece of coat-hanger wire as sketched at the right.

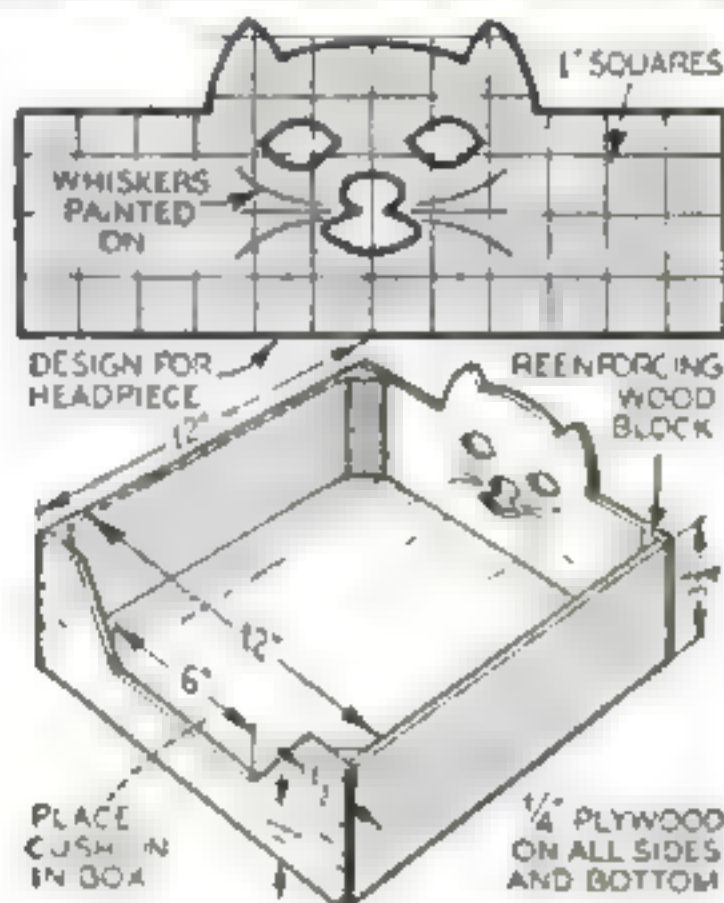
—ROBERT CANTT.





Box Provides a Place for Pussy to Nap

CATS, which are fond of sleeping on upholstered chairs, can be trained to use a cat-nap box made as shown. It is constructed from $\frac{1}{4}$ " plywood, and the corners are reinforced with blocks of wood. The dimensions suggested are suitable for a cat of average size. A comfortable cushion, preferably one filled with cedar shavings, should be made to fit inside the box.—GEORGE A. SMITH.



How the cat-nap box is made. Dimensions are for an average-size cat

Flash Light Used as Bank

A COIN or dime bank that has several advantages over ordinary commercial toy banks can be made from a discarded metal flash-light case. Merely remove the batteries and cut a slit in the side of the case through which the coins may be inserted. Smooth the slot carefully with a file.—FRED CORNELIUS.



After the dry cells are removed, a slot is cut in the case for coins

An Anvil for Light Work

SMALL metal-working vises generally have too small an anvil for practical use, so one shop owner keeps on hand several different lengths of heavy angle iron. One of these is gripped in the jaws of the vise as shown for hammering out light parts of metal projects. Suitable pieces of angle iron, if not already available in the junk box, can be obtained at any junk yard or at a local metal-working shop.—G.S.G.

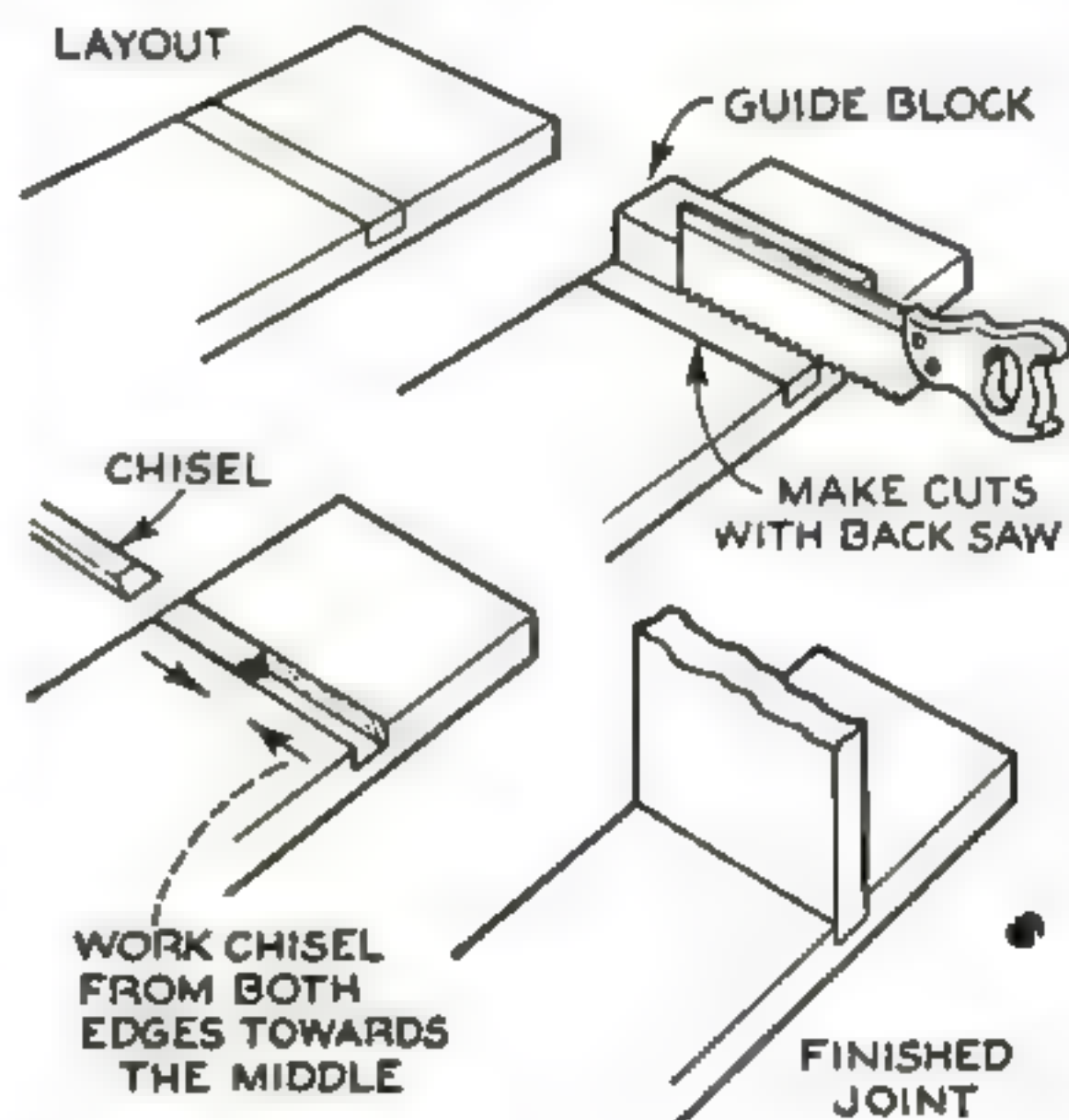


A short piece of heavy angle iron is held in the vise to act as an anvil

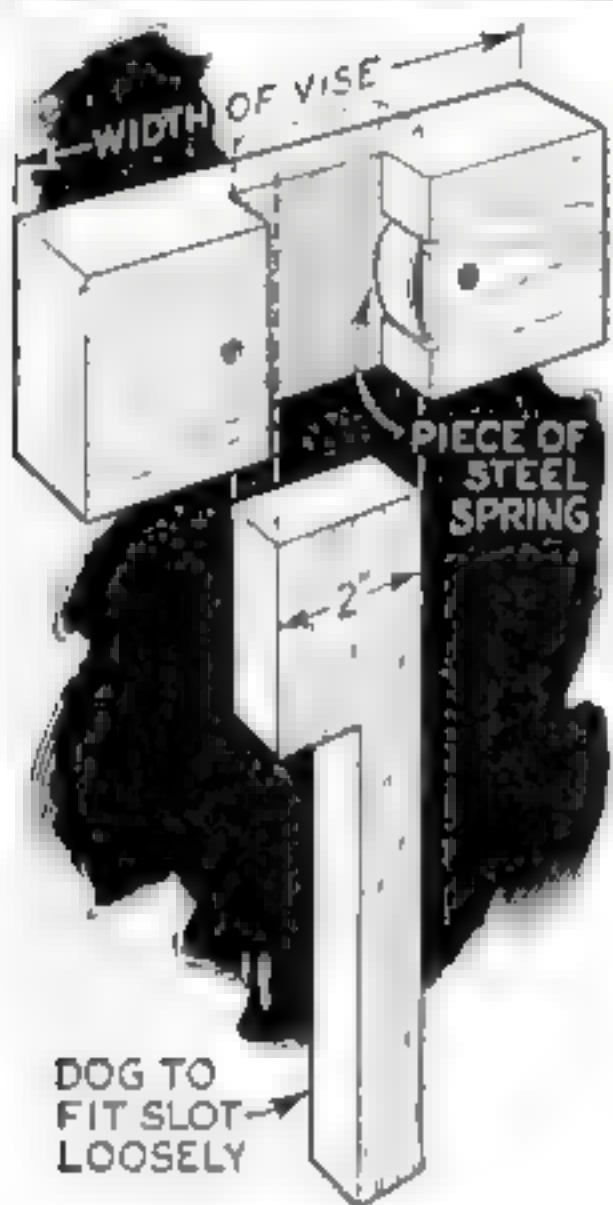
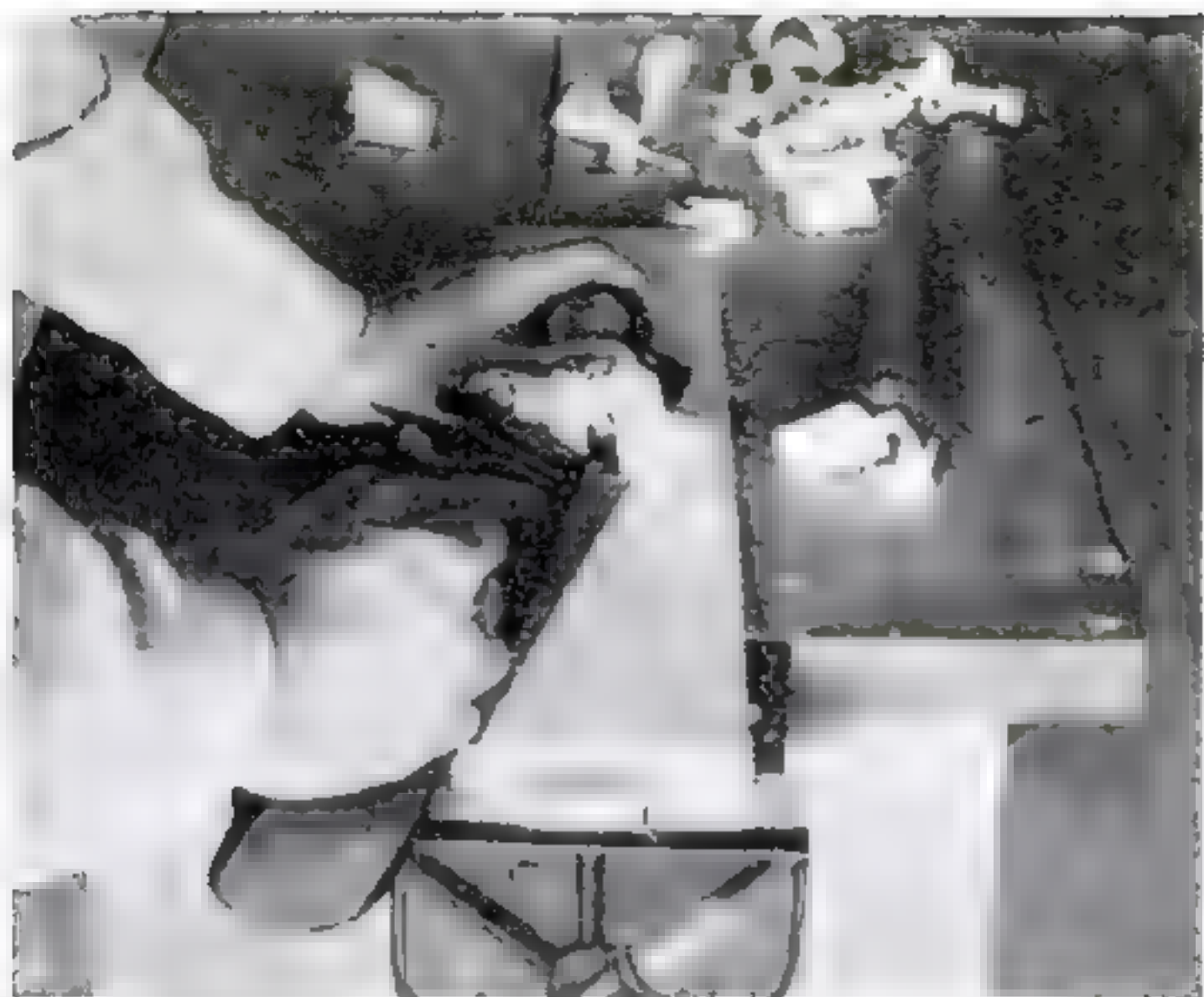
MAKING A DADO JOINT BY HAND

[WOODWORKING]

1. Plane and sand the shelf (or other part) to finished dimensions.
2. Square a line across the side board, measure the thickness of the shelf from this line, and draw another line parallel to the first. Test by placing shelf end on the lines.
3. Gauge depth of dado (usually one half of the stock thickness or less) on both edges of the board.
4. Clamp a block first on one line and then on the other as a guide for the back saw. The saw cuts must both fall inside the lines.
5. Chisel away the waste wood and finish with a router plane, if available. Work from both edges towards the middle.
6. If dado proves slightly narrow, plane the underside of the shelf until it fits tightly. The fit must be snug or the joint will be weak.



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Auxiliary Jaw for Vise Has Movable Stop

MANY iron wood-working vises do not have a stop or plug in the front jaw that can be raised when required for clamping work against a bench stop. Any vise can be fitted with a stop, however, by making a slotted hardwood block about 2" thick. The dog or tongue is cut from 1" hardwood with a long tail or handle to

facilitate raising it from beneath, and a short piece of heavy clock spring holds it in place. This auxiliary jaw is screwed fast to the face of the front jaw.—S. B. MESERVE.

Plug for Hardy Hole of Anvil

PACKED dirt, chips, and filings had frequently to be removed from the hardy hole of the anvil illustrated until a piece of an old bolt was cut off to form a closely fitting plug. Two shallow $\frac{1}{8}$ " holes were drilled side by side in the plug so a pair of long-nosed pliers could be used to remove it.



Improvised Battery Light

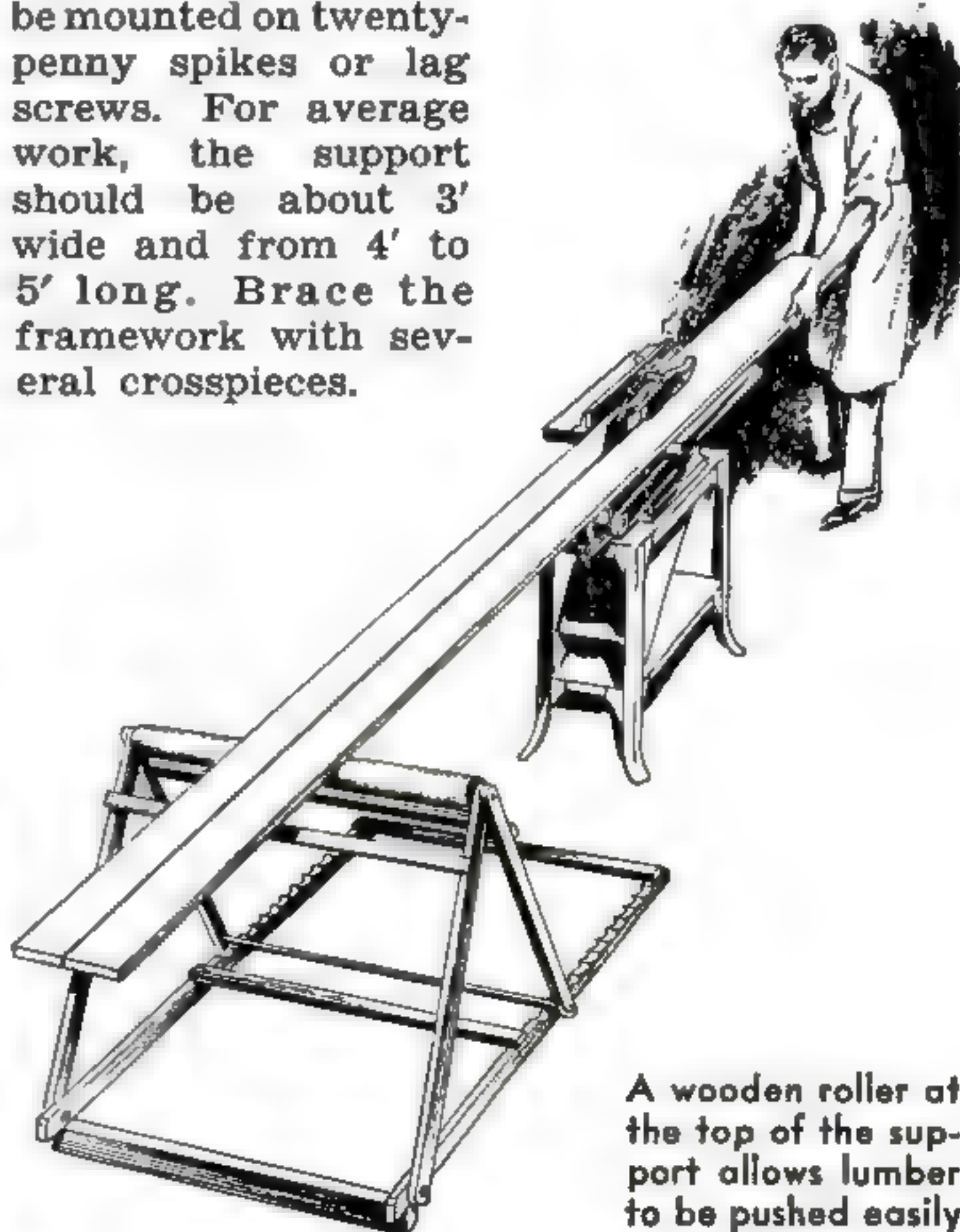
IN AN emergency a battery light may be improvised with the aid of a package carrier of the type having a wire bail and a wooden handle. One end of the wire is fastened to the outside binding post of a dry cell. The other end is bent and the loop opened up so that a flash-light bulb can be screwed into it. The light is then carried in one hand as illustrated above and can be turned on by lowering the hand so that the center contact of the flashlight bulb touches the center binding post of the cell.—R. W.



How the package handle is attached to the cell

Adjustable Lumber Support for a Circular Saw

AN EASILY adjusted end support for lumber being cut on the circular saw may be made as shown. The height is regulated by moving the wooden rod or pipe crosspiece from one point in the ratchet to another. The large wooden roller at the top may be mounted on twenty-penny spikes or lag screws. For average work, the support should be about 3' wide and from 4' to 5' long. Brace the framework with several crosspieces.



A wooden roller at the top of the support allows lumber to be pushed easily



To avoid marring floors by shifting around heavy furniture, a machine waxer and polisher is useful

Hardwood Floors and their care

By RALPH G. WARING

EVERY one admires a beautiful floor, but how to obtain it and how to keep it in condition are problems that require more consideration than is usually given them. A floor has to present the most stubborn resistance to the wear and tear of traffic. When one stops to consider that the average coat of brushed varnish is only $1/250$ " thick, it is little less than miraculous the amount of abuse it can endure from moisture, grit, and abrasion.

The first question is, what kind of floor has to be finished or refinished? The materials used today are generally red and white oak, rock maple, yellow birch, and in some cases comb-grain pine or fir.

While the oaks, especially in the selected quarter-sawed grade, have been used for generations for fine floors, their use appears

VARNISHING NEW MAPLE OR BIRCH FLOORS

[PAINTING]

1. Machine sand or hand scrape and sand to a smooth finish.
2. Stain desired color with nonraising water stain. Cut in not more than five boards or strips at a time. Return and repeat along another similar width until floor is all stained. Dry half a day or overnight.
3. Seal with varnish reduced one half with genuine turpentine. Dry twenty-four hours.
4. Sand by hand with 4/0 or 6/0 paper over felt block.
5. Wipe with rag moistened with turps containing trace of varnish to give tackiness.
6. Varnish with full-bodied, high-grade floor stock. Dry forty-eight hours at 75 deg. F. Revarnish with second full coat if practicable. Dry three days, if possible, before using floor.

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to be declining because less oak is employed for the standing trim or other woodwork in homes. At any rate, oak floors are difficult for the amateur to stain and finish and they do not harmonize in either color or texture with modern walnut, mahogany, or maple furniture finishes. Another drawback to oak is that when it is at all neglected, the floor becomes unsightly in worn areas near doors and on stairs, and it is then quite difficult to restore it to its former condition.

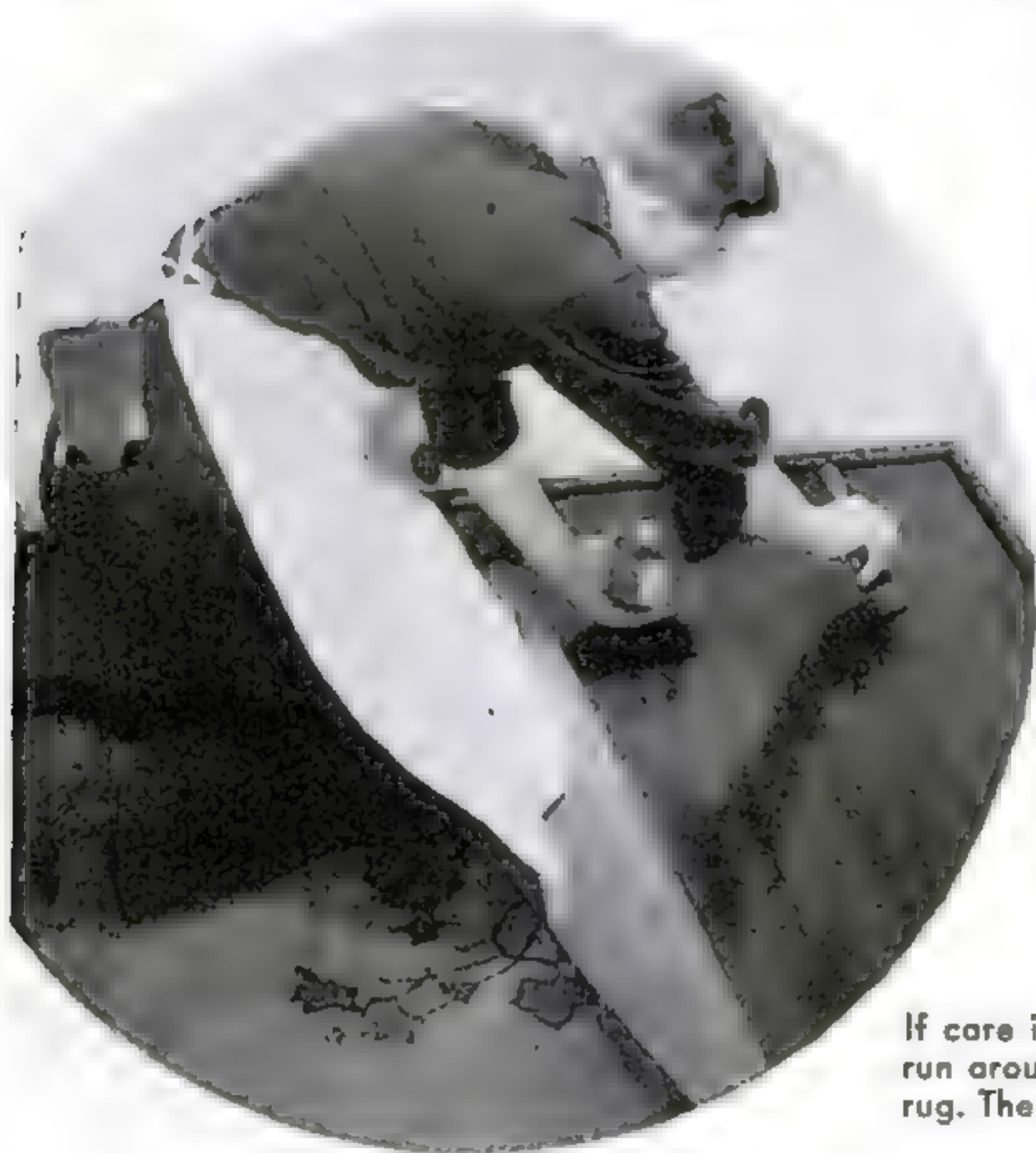
Maple and birch, on the other hand, lend themselves to a variety of treatments and

therefore can more readily be finished, even by the amateur, to form a suitable foundation for a room containing good furniture.

The next question to decide is the general tone, or degree of light or dark. To my mind, one of the abominations that still appears in various classes of homes, both old and new, is the hardwood floor finished "natural" or very light. This is generally done because the contractor found it easier and cheaper or, in the case of old homes, because suitable stains were not available. Today, however, nonraising water stains (stains that do not cause the grain to rise) will give any color desired. They are fast to light and, best of all, will give the floor a deep enough color to provide an adequate color foundation upon which the rugs and walnut or mahogany furniture may rest.

If we regard the tones as ranging from light to dark, and indicate them as I to V, the best combination is when the ceiling is I, the side walls II, the furniture III, the rug IV, and the floor itself V. All too often in an otherwise well-balanced room, the floor is too light in color. The furniture and rugs then appear to float on it without any sense of coming to rest.

Third is the question of durability of floor finishes. That is in direct proportion to the kinds of materials used and the order of their application. Some painters, to "get by" on a



If care is taken, a varnish border can be run around a room without taking up the rug. The rug edges are merely rolled back

VARNISHING NEW OAK FLOORS

[PAINTING]

1. Machine or hand sand.
 2. Stain desired color with nonraising water stain. Dry half day or overnight.
 3. Seal with half varnish and half genuine turpentine, and dry twenty-four hours.
 4. Fill with silex filler that has been colored to match. Follow instructions on filler can. Dry forty-eight hours.
- (In place of operations 2, 3, and 4, the floor may be stained and filled in one operation by using silex filler of the desired color, in which case wipe off very clean and dry forty-eight hours.)
- 5 and 6. Same operations as for new maple or birch floors.

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REVARNISHING OLD FLOORS

[PAINTING]

1. Sand to new wood with machine if possible, or use modern floor-stripping solution and follow directions on can. Avoid undue wetting of floor area.
2. Let dry. Sand with No. $\frac{1}{2}$ or 0 garnet paper along grain. Stain. Dry twelve hours.
3. Refill if necessary to tone up floor and level off cracks. Dry forty-eight hours.
4. Seal with 50-50 mixture of floor varnish and pure turps. Dry two days.
5. Moss off with clean burlap sufficiently to remove gloss. Dust clean.
6. Revarnish with eggshell floor varnish.
7. Dry three days to one week, if possible, before using floor.

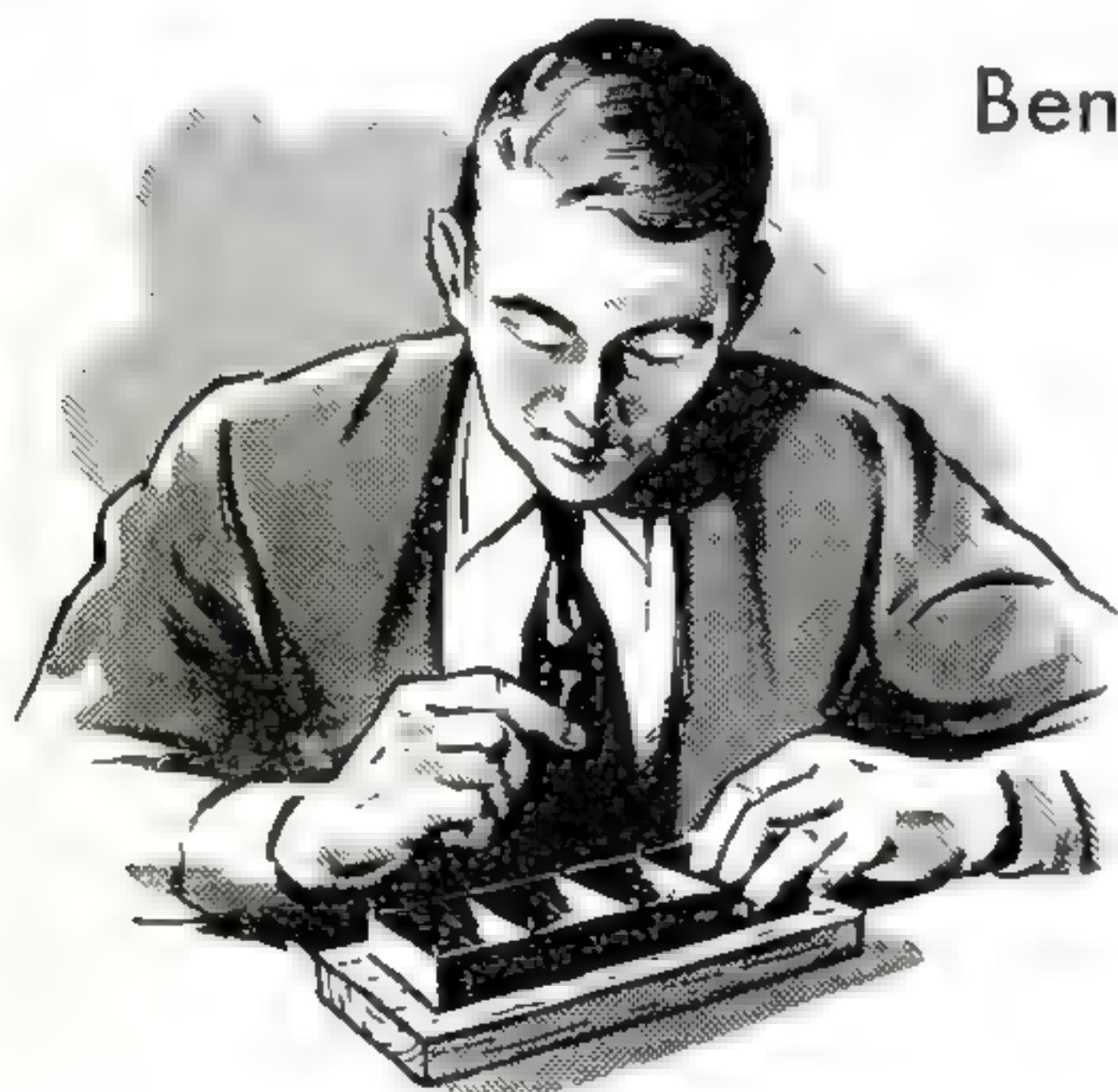
POPULAR SCIENCE MONTHLY SHOP DATA FILE

contract, will use a good coat of shellac beneath the finish coat of varnish. This combination looks well at the time, but will have little or no durability since varnish should never be used over a shellac primer, for which it has but little adhesion. If the final finish is to be varnish, the wood should be primed with the same material reduced one third to one half with pure turpentine. Do not use substitute turpentine.

If shellac is chosen, then use it for the whole finishing schedule. Equal parts of orange and white shellac stock can be thinned with denatured alcohol (not radiator alcohol) in the ratio of one part of shellac stock to three or four of alcohol for the first coat. For final coats use only two parts of alcohol to one of shellac.

While shellac applied in this way gives a good floor, an easier brushing and much more durable and water-resistant finish may be obtained by adding the shellac mixtures prepared as just described to an equal volume of so-called "shellac-mixing lacquer." This produces a splendid finish that quickly dries hard so it can be sanded an hour or two after application. It may subsequently be waxed if desired.

For retouching at a later date, all traces of wax can be washed off with a cloth moistened, not wet, with alcohol. The worn finish is then touched up with a fresh shellac mixture, dried, and rewaxed as required. Do not mix more shellac and lacquer than can be used up immediately as they will not stay in solution if left in the can a week or more.



Bench Tray Holds Small Parts

WHEN you run out of suitable small cans and boxes to hold screws, nuts, and small parts of a machine being disassembled, a container can quickly be made by driving finishing nails into a baseboard as shown and winding friction tape around them to form a series of compartments. If flathead nails are used, simply cut off the heads.

Ship-Model Life Preservers

REALISTIC life preservers for model warships and other models can be made from small rubber tires from toy autos, roped with thread and carefully lettered with black ink.—JOHN E. BARNES.

Rouge Pot of an Ancient Syrian Princess Copied to Make a Modern Powder Box

THIS powder box is a copy of a rouge pot that once adorned the dressing table of a Syrian princess. Designed by some ancient Egyptian artist, the pot was carved in ivory, used in a royal household, and buried in the ruins of the Syrian civilization, to be dug up a few years ago by archaeologists. The duck is conventionalized to a simple shape, and can be duplicated in short order by any home worker.

Either white pine or hardwood is suitable. Sketch a pattern for the parts, and saw the pieces out. If the head is sawed from the top and the waste pieces are bradded back in place, its profile can be sawed as well, leaving very little carving to do.

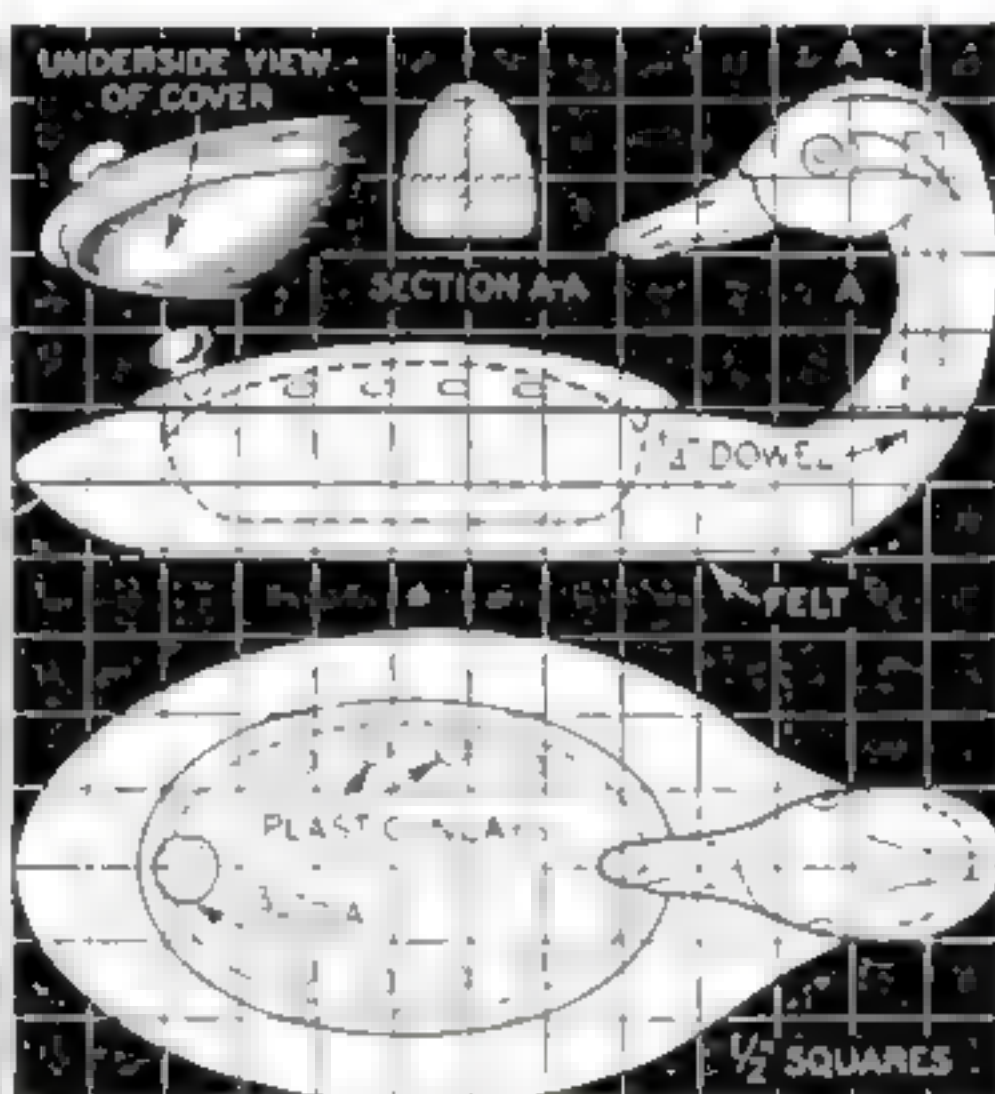


The ivory-enameled box will ornament any dressing table

Gouge out the body, or hollow it with a rotary file, and rabbet the lid edge on a shaper, hollowing the inside or leaving it flat, as desired. Much outside shaping can be done on a sanding disk. After the neck has been roughly carved, attach it to the body with a dowel,



The block for the head is first sawed to shape from the top. Then the waste wood is put back and the profile or side view is cut out



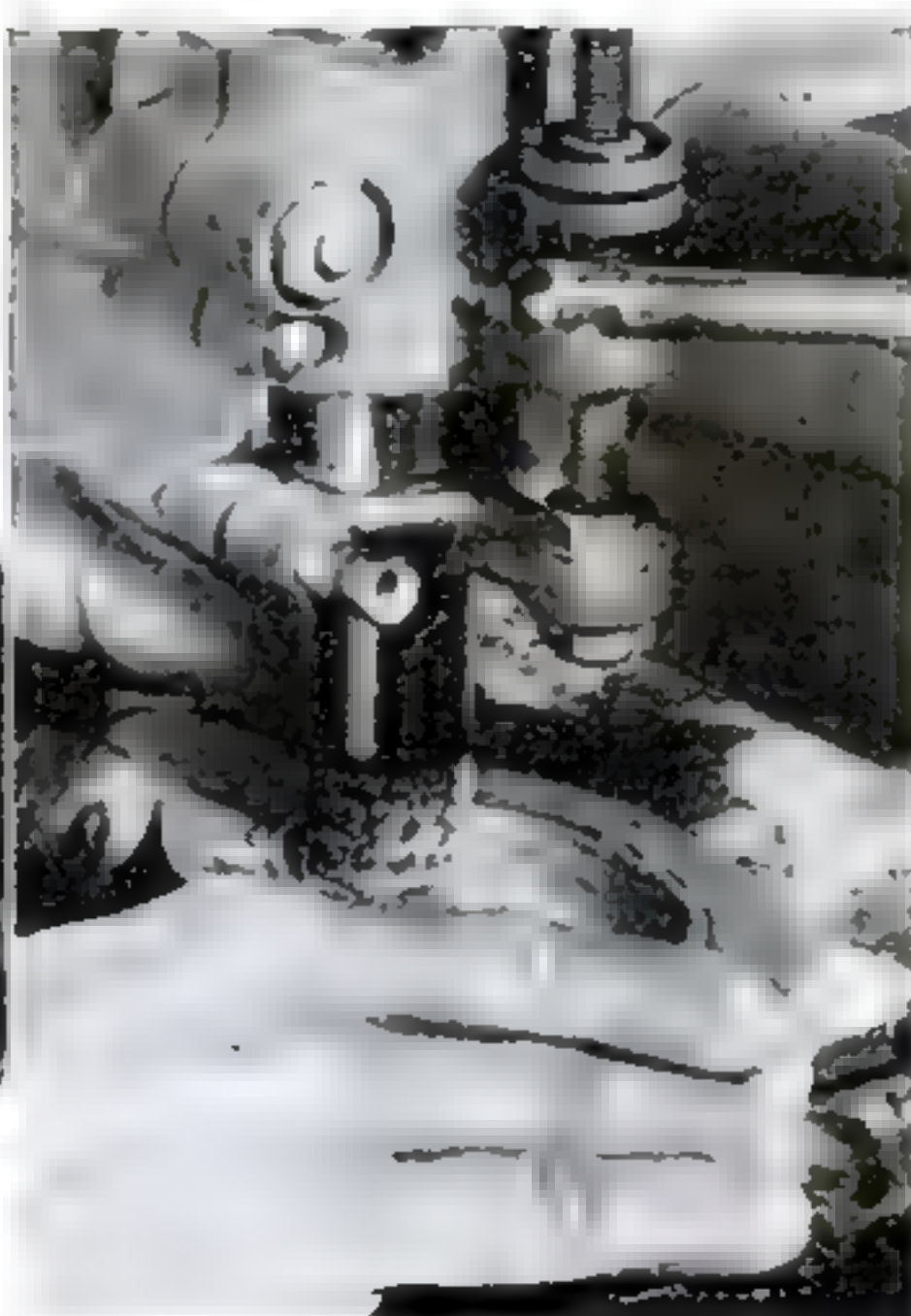
The side and top views, and sketch showing how edge of lid is rabbeted

reinforcing the cross grain of the neck. The eyes and other incised details are cut with a veining tool, or by slitting with a knife point and trimming to a V-cut. Bore $\frac{3}{16}$ " holes $\frac{1}{8}$ " deep for the lid inlays and knob, which are turned from light blue or green plastic and inserted after painting. If rod stock for this purpose is not easy to get, use a plastic drawer pull bought at a ten-cent store. Friction holds both inlays and knob without other fastening.

Finish the duck with ivory enamel, left in full gloss to resemble pottery. Cover the base with a piece of felt.—EDWIN M. LOVE.



Green or blue plastic inlays and knob set off the glossy ivory finish of the duck-shaped box. At right, a rotary file hollows out the wood



Fastening Shades to Their Rollers

WHEN the ends of window shades are reversed so that the unused portion at the top will replace the soiled part at the bottom, it is easier to attach the fabric to the roller with a wide strip of adhesive tape than by using tacks. The fabric is also less likely to become torn in use. Remove the old tacks before attaching the tape to the roller.—W.H.C., Jr.

Tubular

ARE EASY

TUBULAR chimes with their mellow, cathedral-like tones, are a welcome replacement for the old-fashioned noisy doorbell. Their cost today is reasonable and they may be purchased in almost any well-stocked electrical supply store.

If your present front and rear doorbells are located in a spot suitable for chimes—for instance in the front hall—the substitution is a simple matter. Use the common wire that feeds one post of each bell as the common feed for the chimes on the post so marked. The other two wires are then connected in the usual manner. In addition, it is necessary to install a larger transformer, which ordinarily is supplied with the chimes.

The bells, however, are often in the kitchen or side hall, where it would not be desirable to hang the

By

HAROLD P. STRAND



The soft-toned chimes are hung in the front hall to replace the old-fashioned bells (left)



In circle, the protective tube. Above, carrying the wires across the cellar

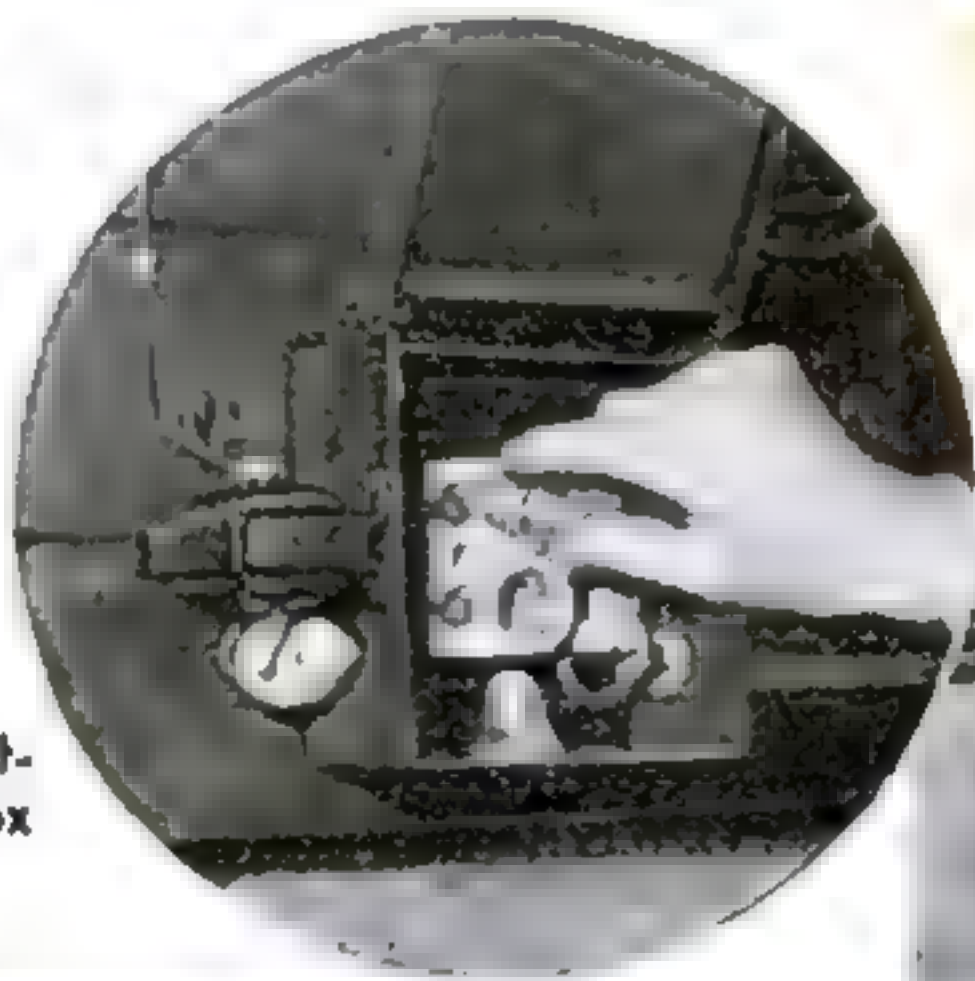
Door Chimes

TO INSTALL

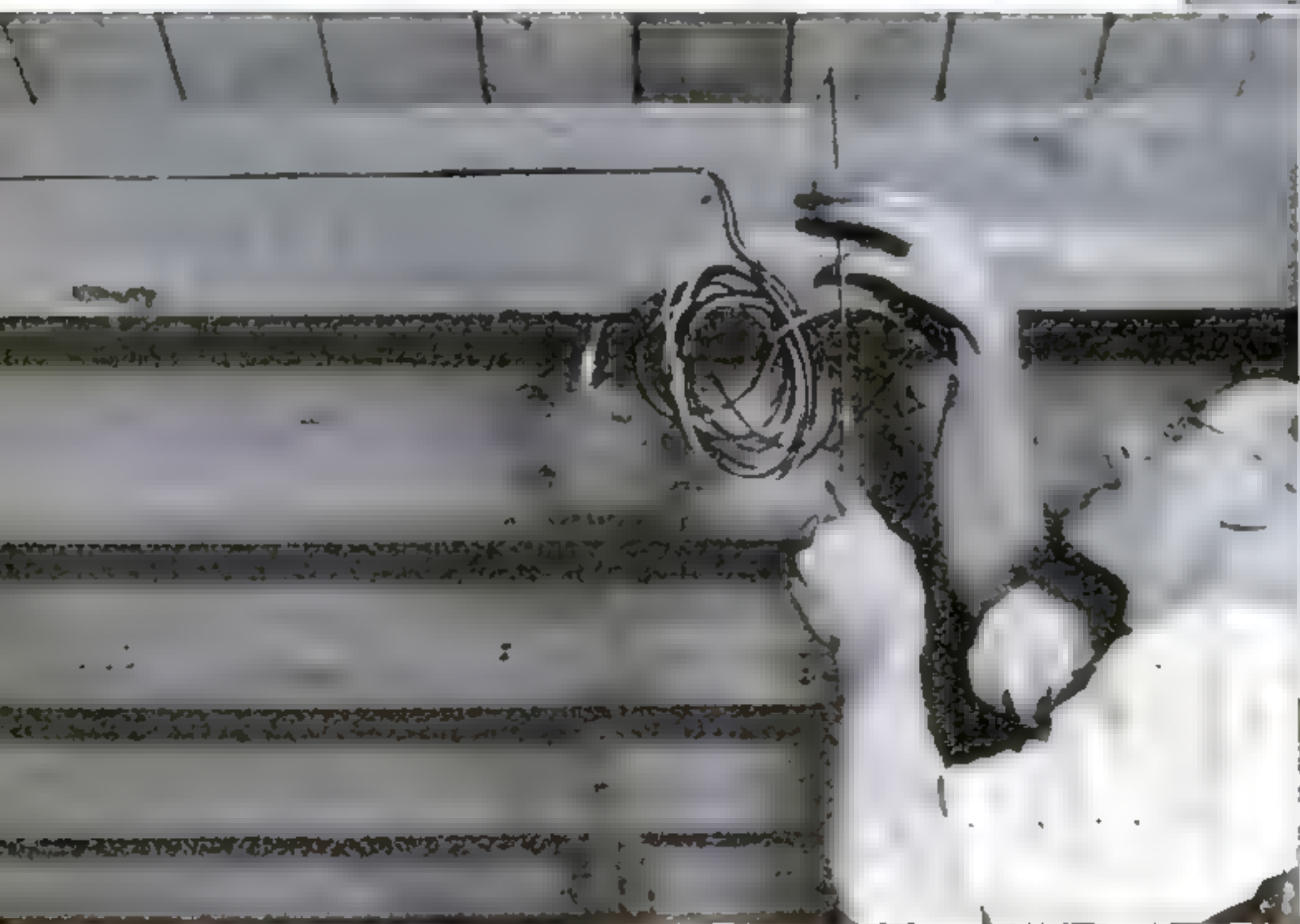
soft-toned chimes. It then becomes necessary to extend the wires from them down to the cellar and across the floor timbers to a point under the front hall. Here they are fished up the partition to the point where the chimes are to be hung. The accompanying illustrations show how this is done.

Usually it is difficult to fish wires down a kitchen wall, so in this case they were carried through the partition to a closet behind, where they were spliced to three new wires of different colorings—a white wire for the common feed, a black wire for the front bell wire, and a blue wire for the rear. Rubber-covered wire was used because it is better for all bell work than the cotton-covered variety often used. The wires were then run down the corner of the closet and fastened with insulated staples. At the point where they pass through the floor, a small copper tube was placed as a protection and secured to the base-

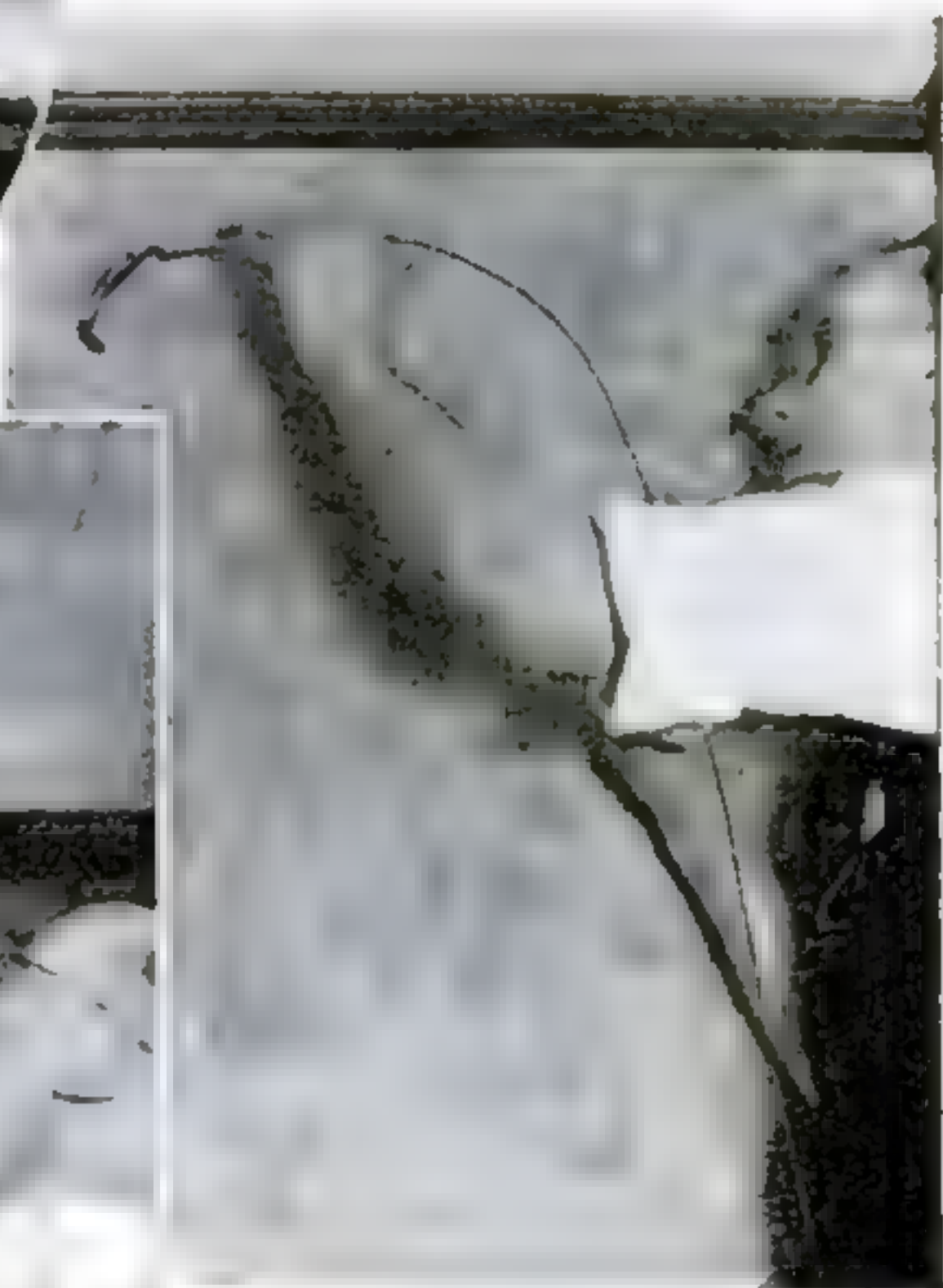
The new transformer is attached to the metal fuse box



Adjusting the variable resistance so that only one chime will sound when rear-door button is pressed



Passing the fish wire up through a hole under the front-hall partition



The fish wire has been caught high up inside the hall wall by means of another fish wire inserted through a hole, and the bell wires pulled up and out

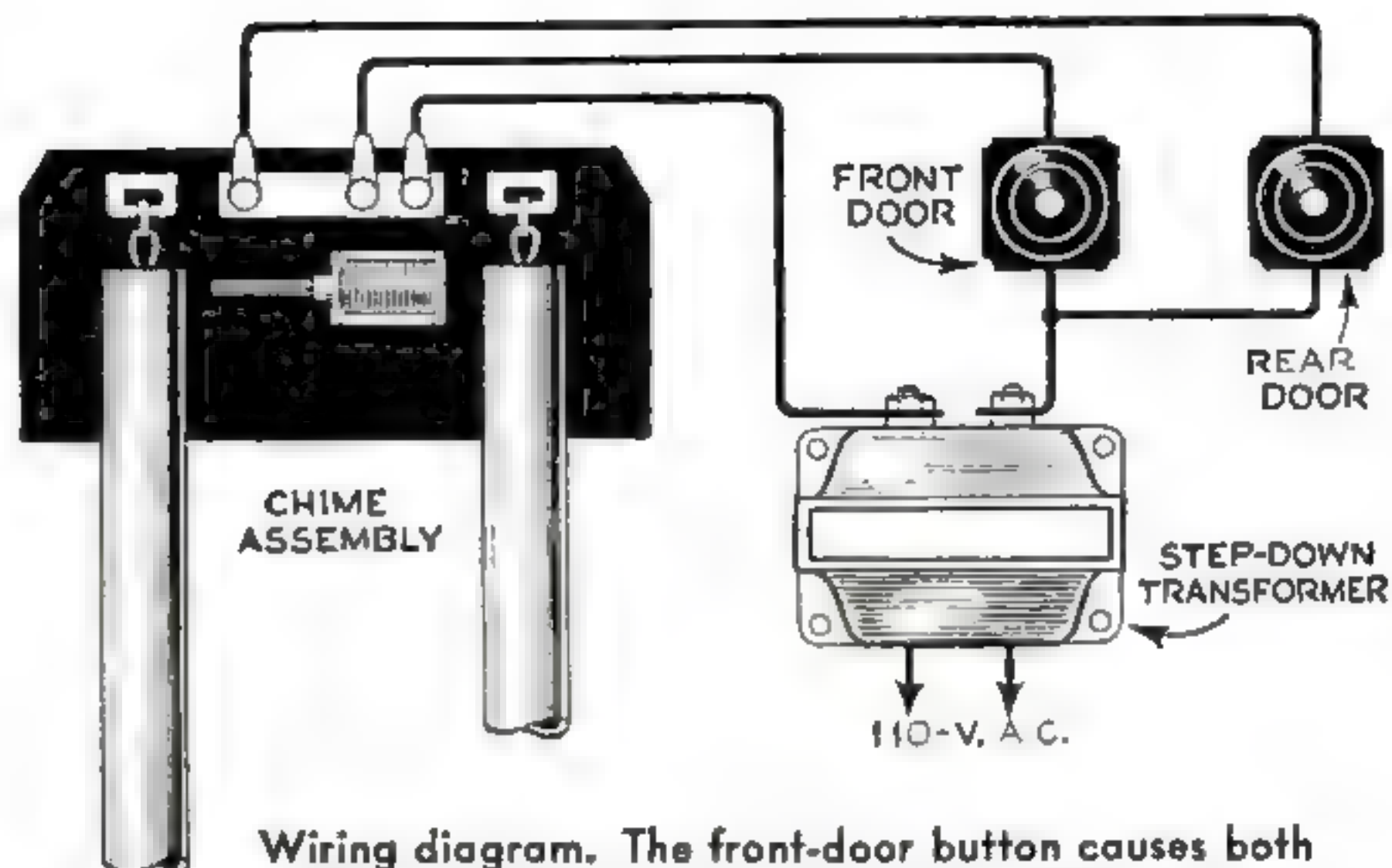
board with a strap made from sheet copper.

In the cellar, many timbers had to be crossed, so laths were first nailed up and the bell wires stapled to them. Under the center of the front hall partition a hole was bored and a fish wire passed up the wall. This was caught high up on the hall wall and pulled out through a small hole in the plaster and lath. Such a job usually requires an assistant to help catch the fish wire. The original one is pulled back until the two hooks catch, at which position the wire can be brought out of the hole.

The base of the chimes was screwed to the wall and the wires connected. The tubes were hung on their hooks and the lateral position altered to get the best tone by means of toothed slots.

A variable resistance is provided, and this must be adjusted to choke the current sufficiently when the rear-door button is pressed so that the plunger will not quite strike one of the chimes. Then, when the push button is released, the spring returns the plunger and strikes a single note. When the front-door button is pushed, both chimes are struck.

As a precaution against fire, it is best to attach the new transformer to the metal box at the meter board rather than place it on the wood. If the box cover will not then close



Wiring diagram. The front-door button causes both chimes to sound, but the rear-door button, only one

entirely, a notch can be hack-sawed in the edge of the cover to clear the transformer. In case the fuse box is large enough to accommodate the transformer, install it inside, using a porcelain bushing in one of the knock-out holes for the bell wires to enter. It is better never to fuse a transformer of this type over 3 amperes for maximum safety.

Rubber Tacks Prevent Scratches on Drop-Leaf Table Legs

IF THE leaves of a gate-leg table mar the finish on the legs when they are dropped, insert rubber-headed tacks in the underside of the leaves at the points of contact.—C.B.

Western Neckerchief Slide Made from Cow Horn

A SCARF holder or neckerchief slide, especially suitable for Boy Scout use, may be made with little difficulty from a cow horn. It will outlast slides made of wood and other materials. After obtaining a suitable horn from a butcher, farmer, or

dealer, probe with a wire to find where the hole stops, and saw the point off as near that position as possible so that the finished slide will not be too large. Then cut the other side on a slant as shown. Scrape the horn smooth with a sharp knife or piece of glass. Any desired design, lettering, brand, or initials may be engraved in the surface with a hot needle, or may be carved and filled with colored wax.—DONALD SMITH.

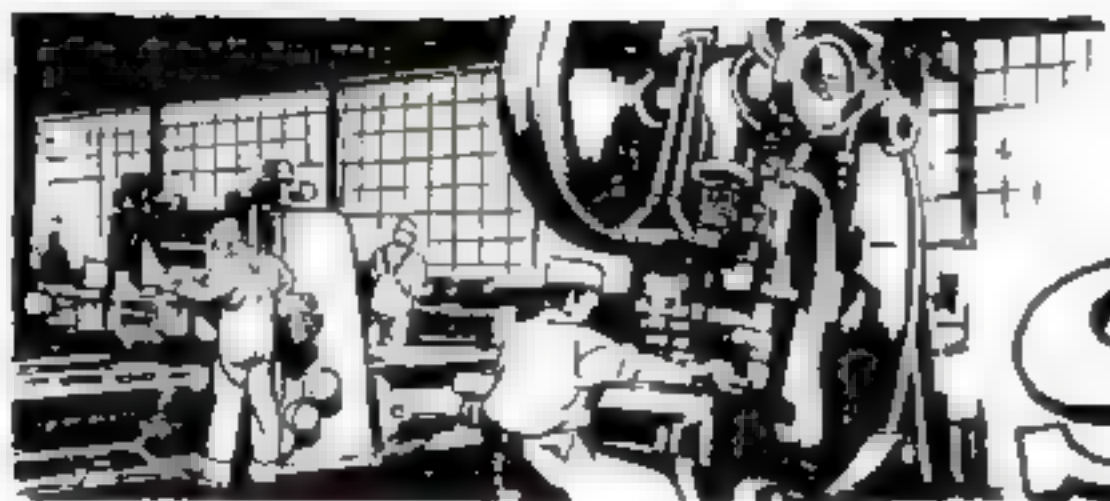


How the cow horn is cut, and the finished slide with neatly burned-in initials

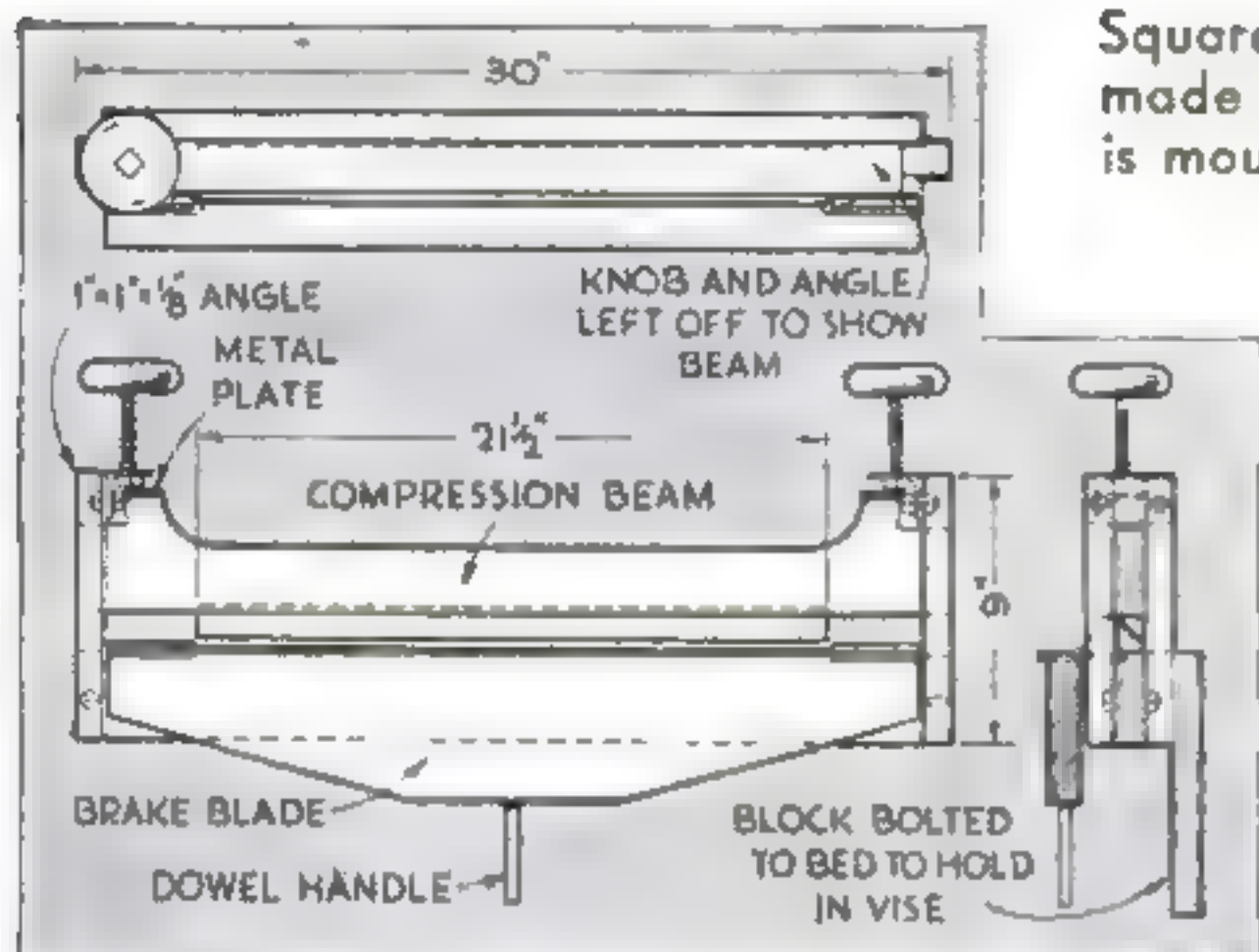
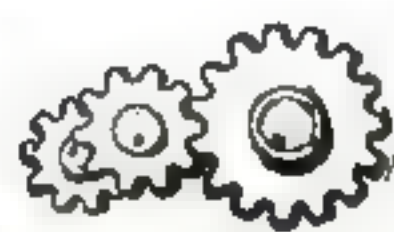


Partly Empty Paint Cans Stored Upside Down

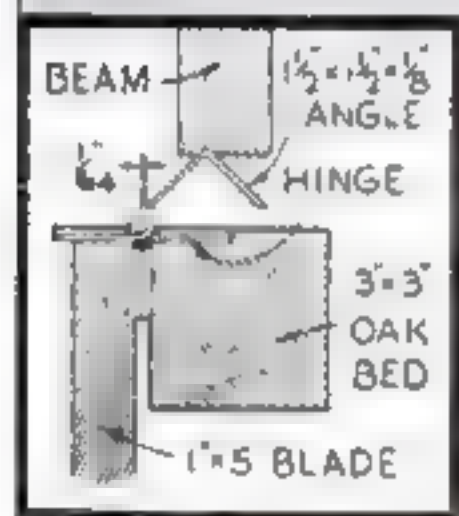
MUCH paint is wasted in the average home workshop because a thick skin forms on the top of the pigment in partly empty cans. This can be avoided by driving the top of the can in tightly so there is no chance of leakage and storing the cans upside down. The paint is effectually sealed against the air and will remain liquid almost indefinitely without the formation of a film on top.—STERLING SLATER, JR.



new SHOP IDEAS



Square, accurate bends are made with this brake, which is mounted in a bench vise



Front, top, and end views and, at left, a cross section to show relation of the pressure beam to the other parts



A Light Brake FOR BENDING SHEET METAL

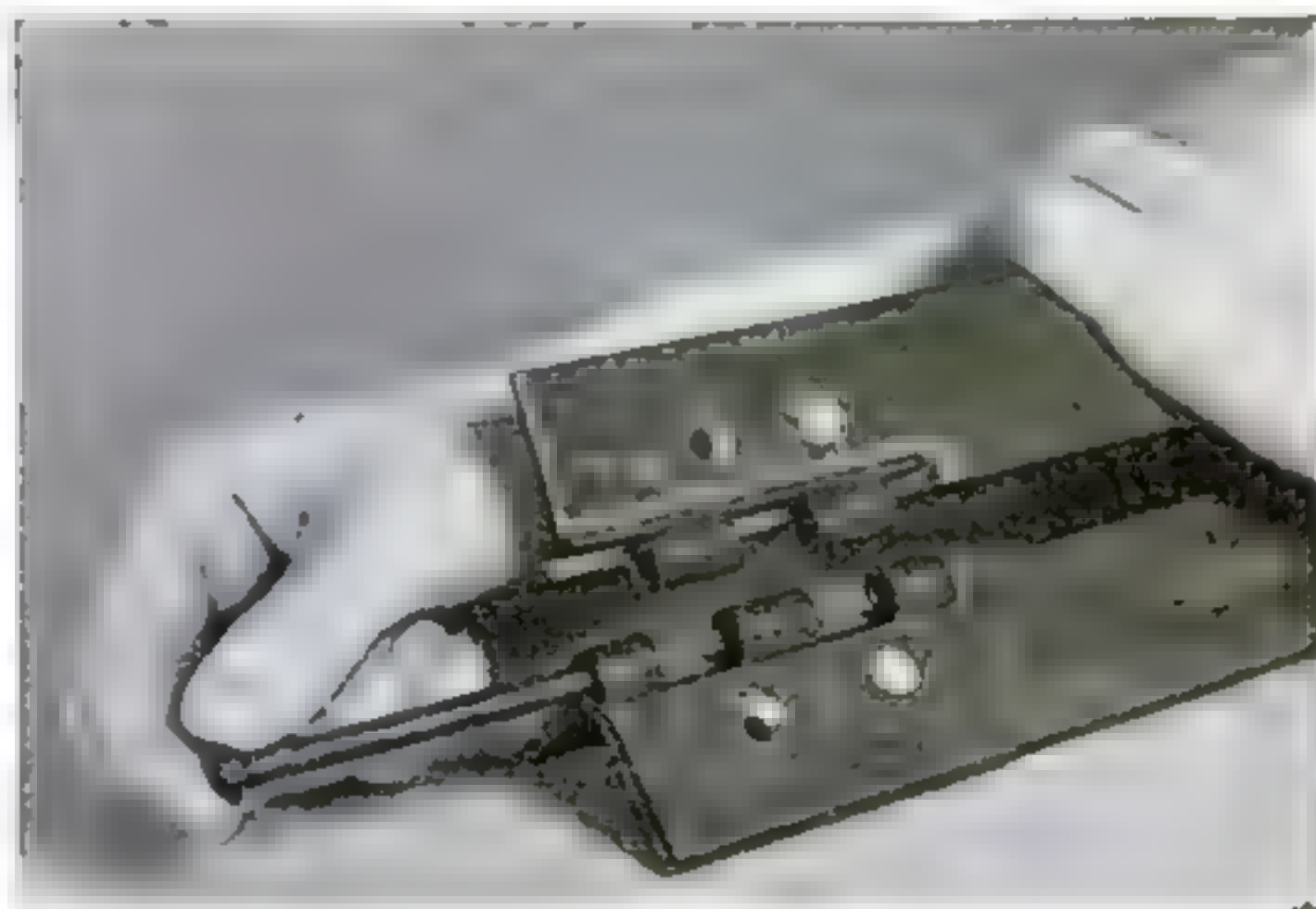
WITH a so-called "brake," or tinsmith's bending machine, made as illustrated, the mechanic who does sheet-metal work can obtain square, straight bends and corners without difficulty. The original model was built almost entirely from angle iron taken from an old iron bedstead, but even if new materials are used, the cost of constructing a similar machine is quite small.

The capacity of the brake is 21 in. in length. By increasing the size of the angle iron and the hinges, a larger machine could be made, if desired. General dimensions have been indicated on the drawing, but the builder can modify them as necessary to suit the available materials and the size of brake needed.

Braking hinge assembly. Select two pieces of angle iron $1\frac{1}{2}$ " by $1\frac{1}{2}$ " by $\frac{1}{8}$ " and 28" long, as straight and true as possible, with good, sharp corners. Grind or hack-saw away the corners at both ends so the hinges may be placed as shown at right. In other words,

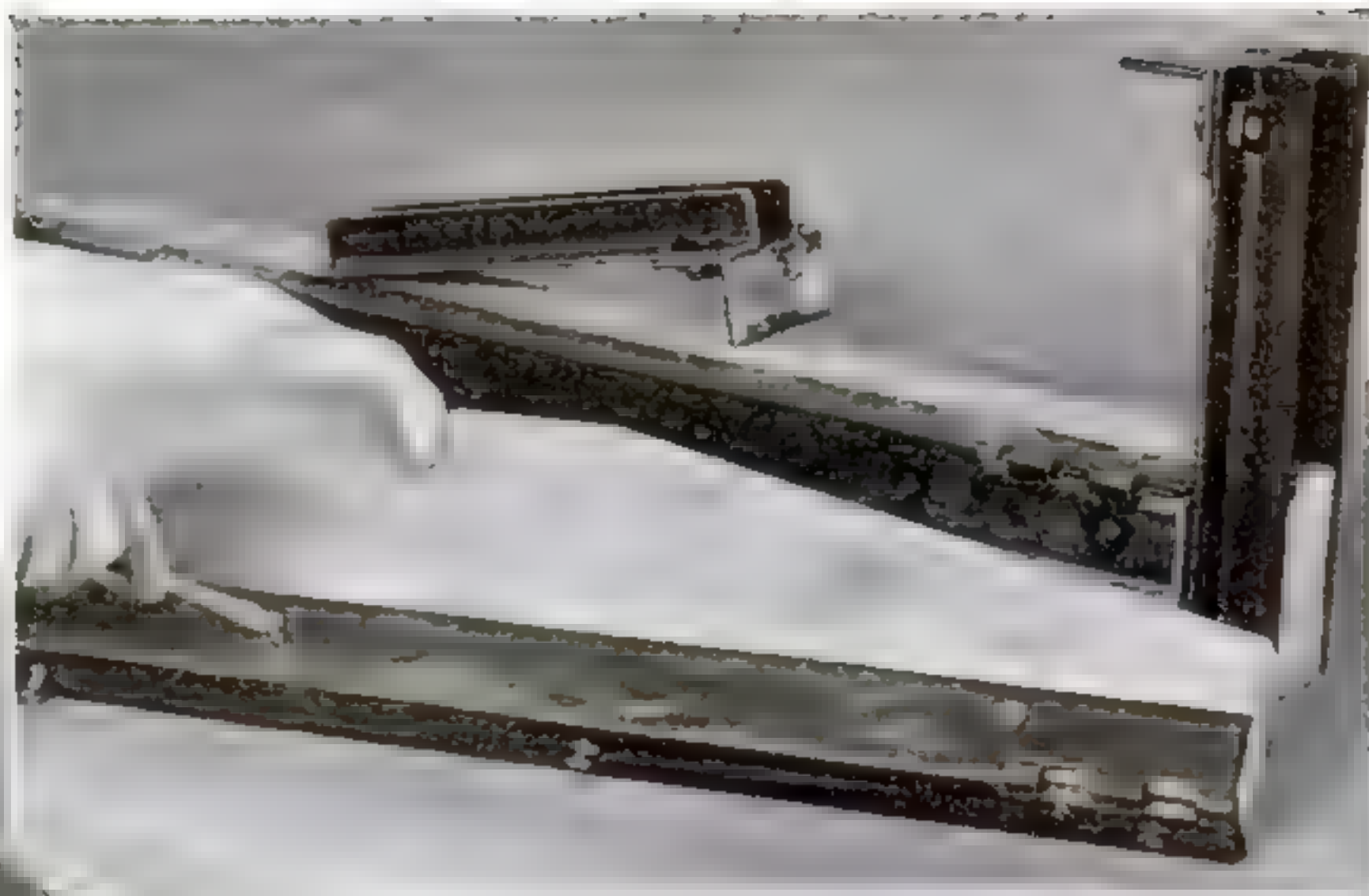
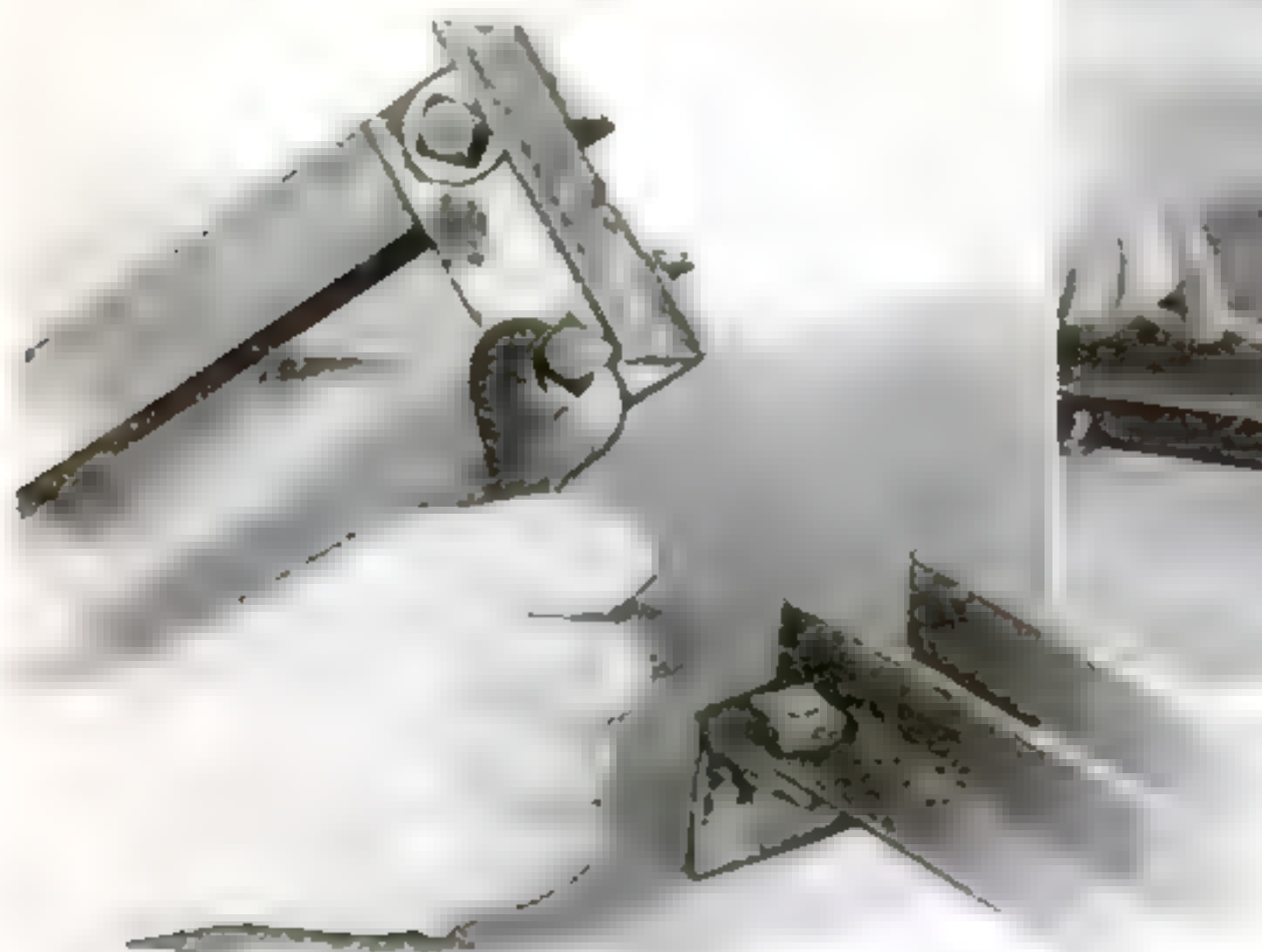
the corners of the angle irons must line up with the center of the hinge pins. The hinges are common 3" by 3" steel loose-pin butts. Only one rivet through the angle iron and each hinge leaf is necessary at this stage of the construction.

Brake bed. This is hardwood, 3" square and



How the hinges are let into the angle-iron corners

Below, each pair of uprights has a short crosspiece to support the compression screw. Right, screwing the hinge-blade angle to the brake blade; in background, the bed



30" long. Recess the top along the front edge so the bed section of the hinge assembly will lie flush with the top of the wood. Three or four countersunk flathead screws through each face of the angle iron into the bed will be sufficient. Also drill a hole near each end so a screw can be driven through both the angle iron and the leaf of the hinge into the wood.

Brake blade. Use 1" by 5" by 28" hardwood, shaped as shown in the drawings and fastened to its section of the brake hinge with screws.

Uprights. These are made from 1" by 1" by $\frac{1}{8}$ " angle iron. Four are required, 9" long. Each pair has a connecting piece of $1\frac{1}{2}$ " angle iron, $3\frac{1}{4}$ " long, at the top. These crosspieces carry the compression screws.

Compression beam. Formed from $1\frac{3}{4}$ " by 4" by 30" hardwood, it is grooved in the bottom edge to take the clamping blade, which is a $21\frac{1}{2}$ " length of $1\frac{1}{2}$ " angle iron set like

an inverted V as shown in the cross-section drawing. The bottom of this beam should be given a slight curve or crown so as to press more firmly in the center when in use. A shallow angular groove is cut in the wood for the blade to rest in. The angle or corner edge of the blade must be ground or filed until it fits the bed, and it is then screwed in place. At each side are placed small C-shaped springs to raise the beam. One of these can be seen in a photograph below.

The beam itself is tenoned as shown in the same view to slide up and down. (The bed is also tenoned, but is slightly larger to give clearance for the beam.) The top surfaces of the beam near the ends are protected with small metal plates to take the thrust of the compression screws. These screws are $2\frac{1}{2}$ " by $\frac{3}{8}$ " or $\frac{1}{2}$ " bolts fitted with hand knobs. They pass through holes drilled close to the corner of the angle-iron crosspieces so as to prevent the nut from turning.—R. O. LISSAMAN.



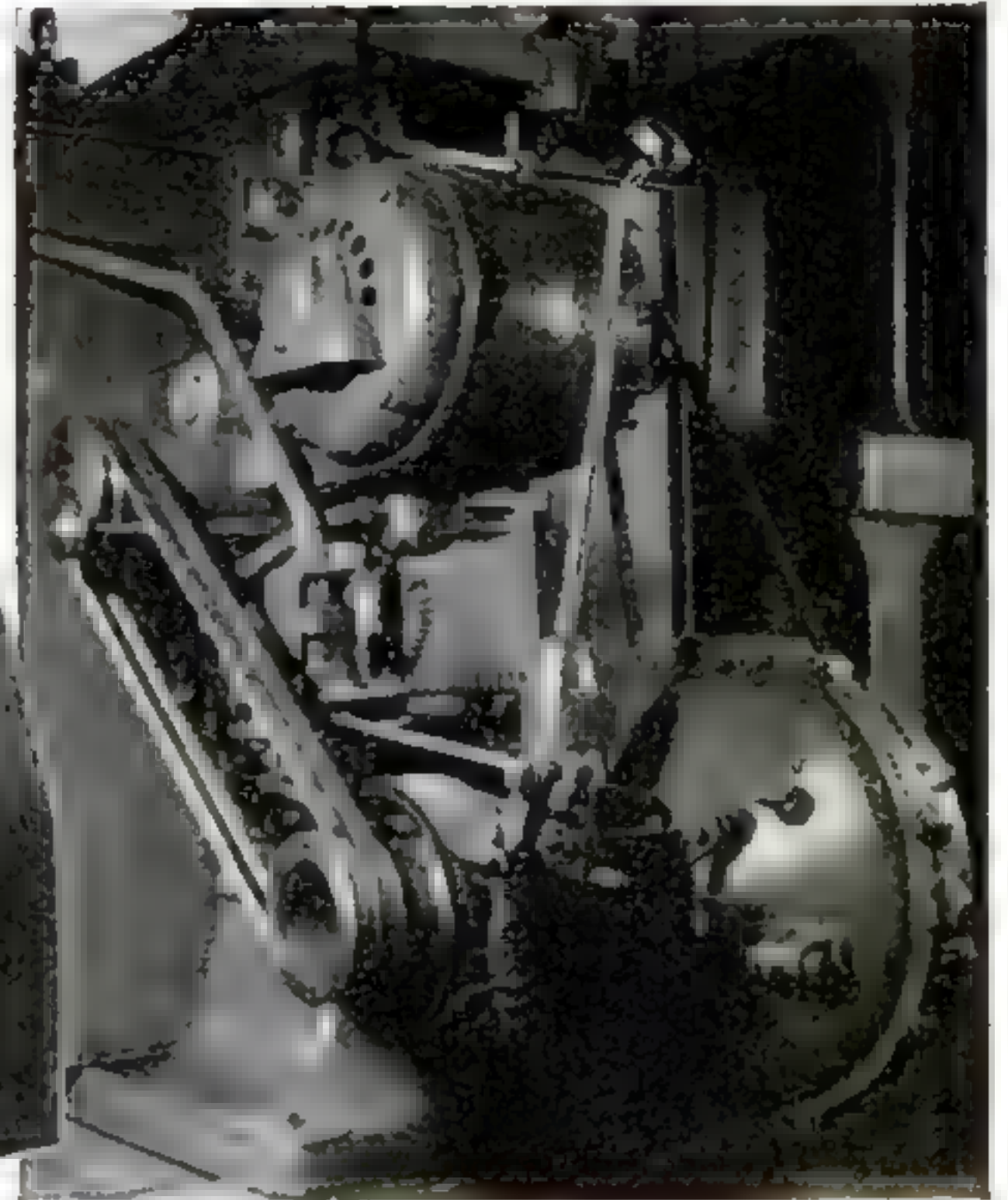
Each bolthead is let into the wooden knob to prevent the screw from turning, and a nut is then run tight against the underside

The compression beam is grooved to receive the angle iron that forms the blade. Note the spring made from bicycle trousers clip

New Drive Improves Old Shaper



Shaper modernized with a four-speed drive built from an old transmission



The drive with casing removed. When the clutch is thrown, a cam releases the brake

TO MODERNIZE an out-of-date shaper, the machine-shop students in a western high school built a highly efficient, noiseless drive from an old auto transmission. Four speeds are obtained through the use of the reverse gear, and the drive has both clutch and brake.

A large square steel plate was bolted to the back of the shaper to form a vertical mounting for the motor and transmission. The clutch flywheel was removed and set up in a lathe so the starter teeth could be removed and a V-belt groove cut in the outside

face. A V-belt was stretched from motor to flywheel. Because the final drive pulleys to the shaper are small, two parallel belts are used to give the necessary traction. The clutch is operated by a conveniently located handle, having a rotating cam at its base. By throwing in the clutch, the cam releases the brake through a connecting link. An accessible starter switch for the motor and a sheet-iron case were added.—W. F. DEBOLD.

Copper Sleeve on Drill Shank Prevents Breakage



IF A SHEET of 0.010" or 0.015" copper is shaped to fit the drill shank or sleeve as shown, a drill used for heavy work in the lathe will not damage the spindle in case it catches and turns in the socket. Since the drill need not in this case be held with a dog to prevent its turning, the risk of breaking the drill, spoiling the work, or pulling it out of the chuck is also minimized. For most work, this causes no appreciable inaccuracy.

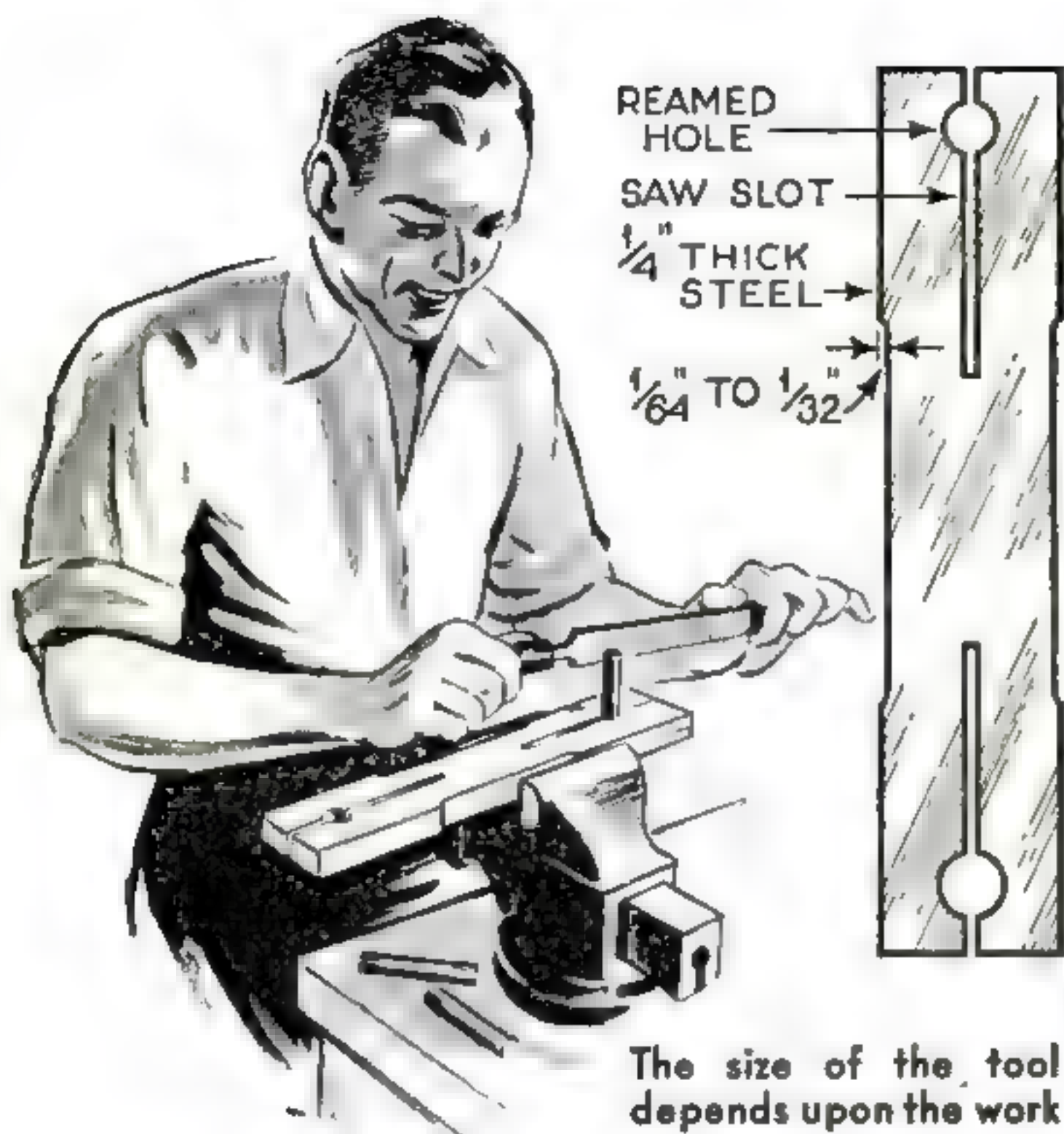
When using smaller drills or for work in which the drill is especially likely to catch, the copper sleeve may be made only about one third the effective length of the drill shank or sleeve. In making the sleeve, leave a small gap between

the edges so that the sleeve will not become so tightly wedged as to make removal difficult.—ROBERT B. DOUGLAS.

Counting Turns in the Lathe

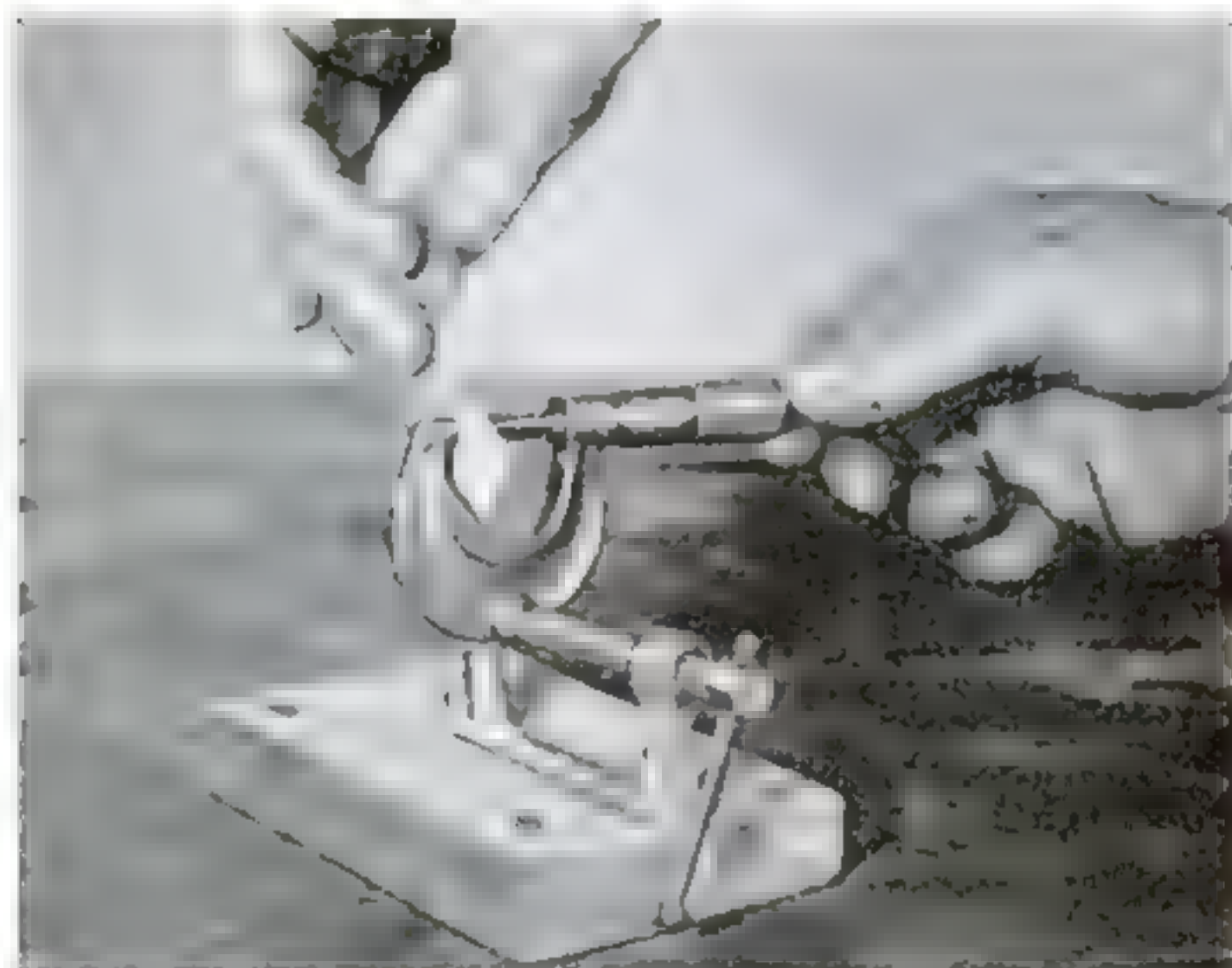
FOR coil winding or other lathe operations that require the number of turns to be counted, a revolution counter may be mounted so the tip enters a hole cut in a large rubber cork inserted into the outer or left end of the headstock spindle.





C-Clamp Mounted on Base for Holding Calipers

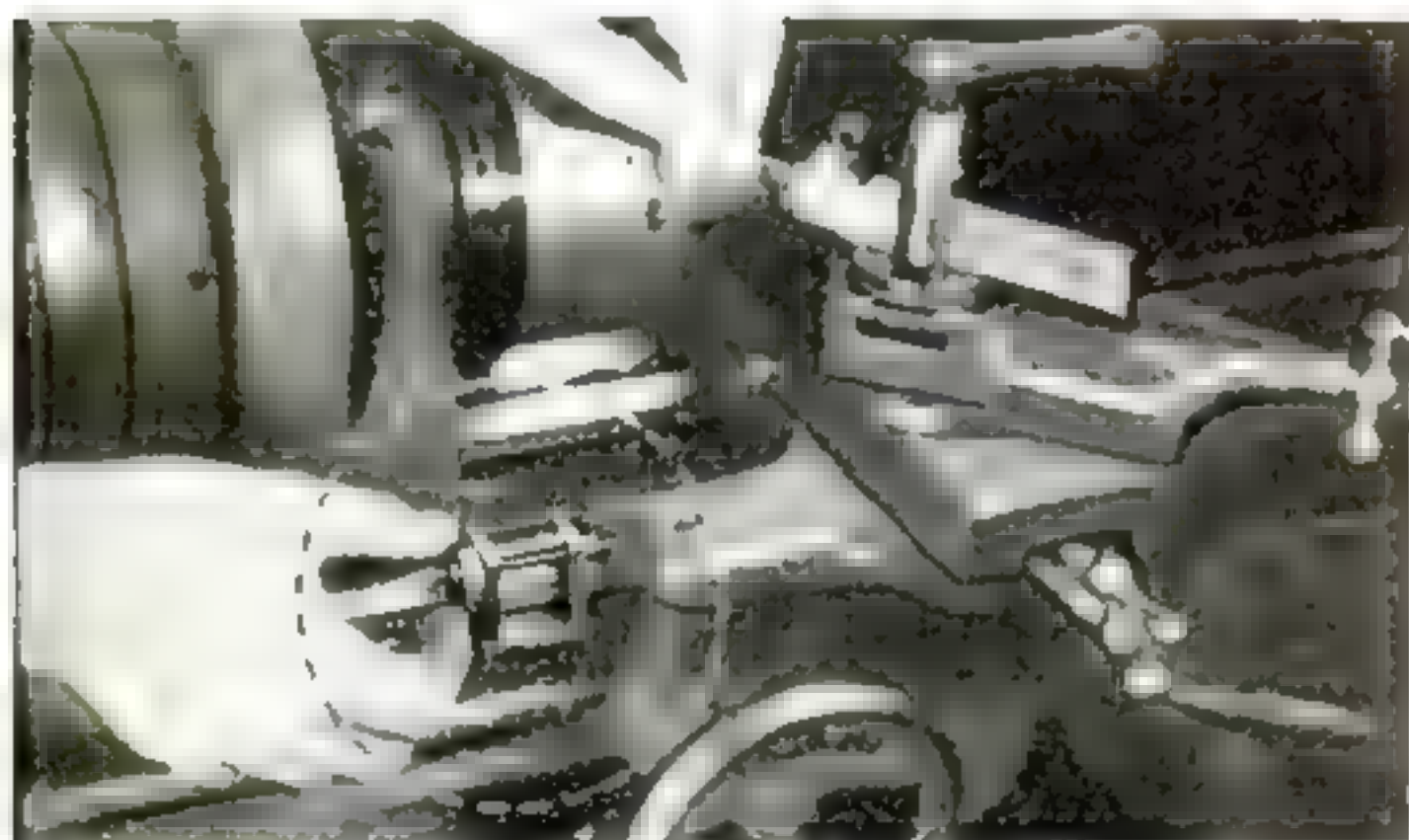
ONE or two good-sized C-clamps, mounted upright on wooden bases, are useful for holding a micrometer as shown to enable rapid measurements to be taken, and also for holding rules, inside and outside calipers, and other tools. Make a narrow slot in the base to receive the rib on the clamp and temporarily stop the ends of the slot with thin wood or cardboard. Then set the clamp in place and fill the remaining space in the slot with melted sulphur or lead.



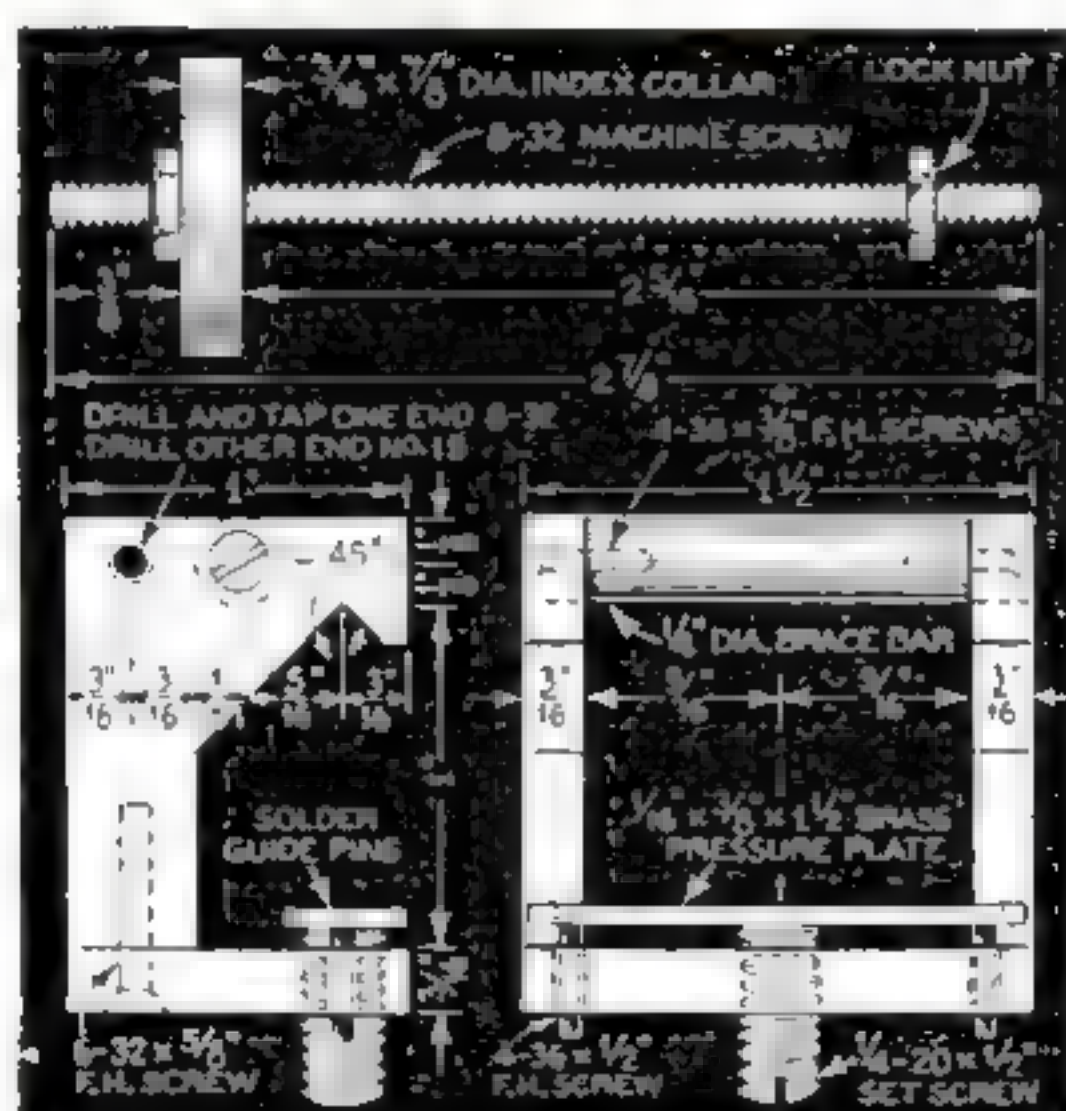
Convenient way to hold micrometers for special work

A Heavy-Duty Pin Vise

WHEN a number of steel pins of certain standard sizes have to be filed, cut off, or slotted, it pays to make a rugged pin vise of the type shown above. Holes for pins should be drilled and reamed, and the stock should be slotted and also recessed slightly on both edges as indicated for use in a machinist's vise.—PETER F. ROSSMAN.



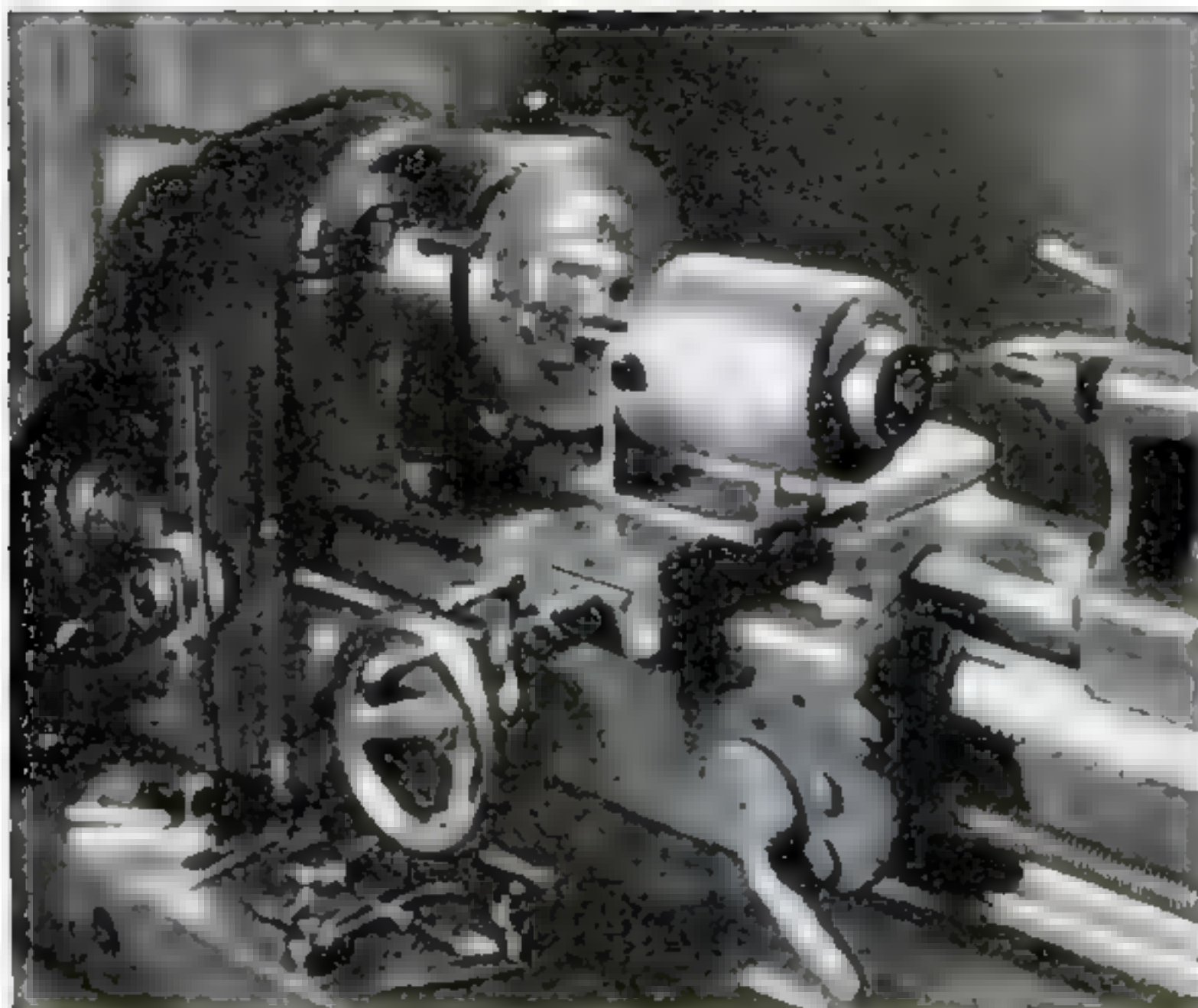
The assembled stop and, above, in use on a lathe. At right are the drawings



Accurate Carriage Stop for a Small Lathe

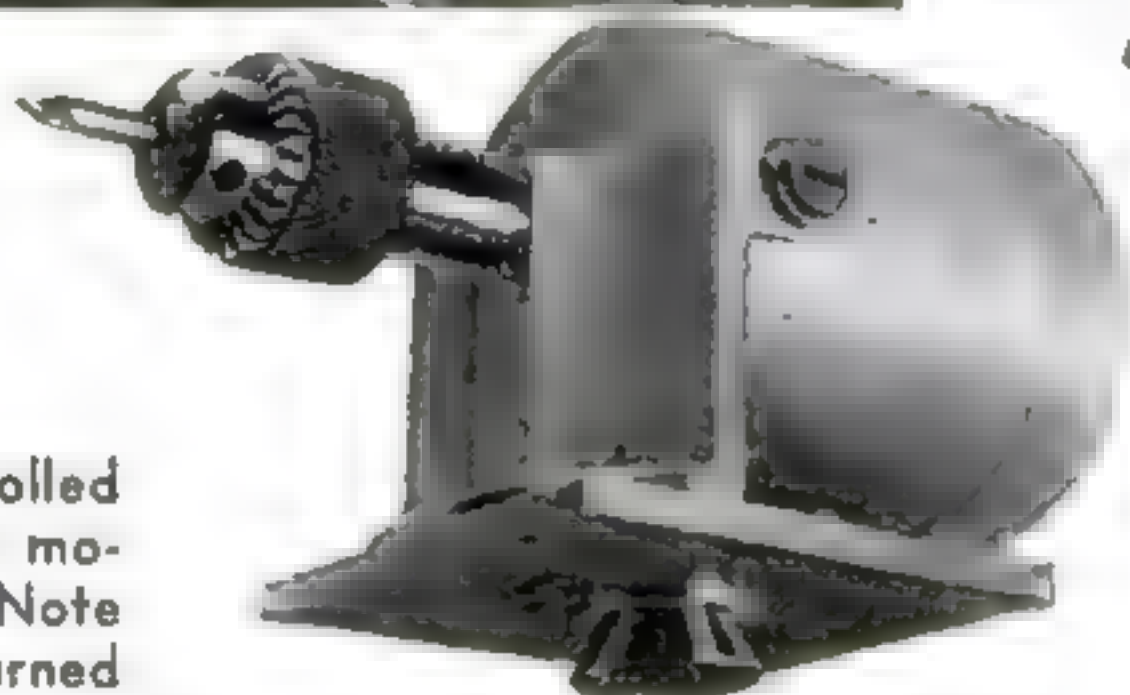
IN THE absence of a regular micrometer carriage stop, the homemade one illustrated will serve satisfactorily for occasional needs. It measures to $1/64$ " or $1/128$ ", and if used as a fixed stop in conjunction with a feeler gauge, it may be set for small increments down to a few thousandths of an inch.

The size suggested will be suitable for a carriage stop for a small 9" lathe. Dimensioned drawings are given at the left, and the stop is shown alone and on the lathe. The body is built up of $3/16$ " by 1" brass, and the pressure plate is $1/16$ " brass. A piece cut from a 3" long 8-32 screw serves as the micrometer screw and is fitted with an index collar divided into fourths (see "Three-Jaw Chuck and Level Used for Simple Indexing," P.S.M., Aug. '38, p. 72). An advance of one mark thus corresponds to a carriage travel of $1/128$ ".—G. F. LAMPKIN.



The motor is moved along ways of lathe with the carriage or across with the slide

Close-up of cold-rolled steel base on which motor is mounted. Note lug underneath turned to fit lathe cross slide



Timesaving Motor Drill for Your Shop Lathe

IN ANY shop where the lathe is the main machine tool, this little drill will find many uses. It is simply a motor fitted with a chuck and mounted on the cross slide. The base is cold-rolled steel of a thickness to bring the motor shaft centers to the exact height of the lathe centers. The projecting lug on the bottom of the base is a duplicate of the one used to hold the compound rest in place. A chuck arbor is turned to fit the tapered bore of the chuck and drilled to fit tightly on the motor shaft, where it is held with a set screw.

Very accurate spacing of holes can be obtained by using the lathe change gears for dividing and also by the vernier on the cross slide screw. When measuring is done in this manner, no center punching is necessary, but a small center drill should always be used first in order to start the holes true.—C. WARREN WOODSON.

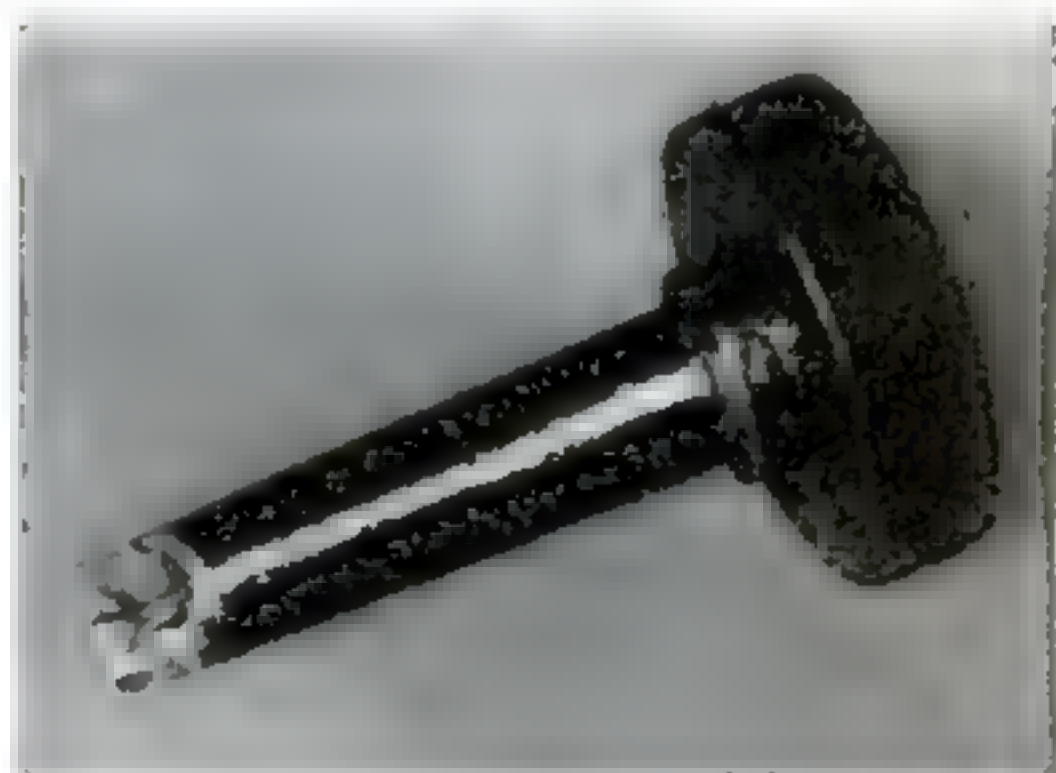
Old Brake Drums Act as Wheels



The complete welding outfit is easily moved about on the brake-drum wheels. Above at right, how wheels are held



OLD brake drums, an automobile axle, angle iron, and other odd parts found around the shop were used by a Michigan garage owner to construct the truck shown for wheeling an acetylene welding outfit from job to job. The bent rods that serve as handles are covered with pieces of garden hose to protect the hands.—CLIFFORD LEESTMA.



Broken Shank Is Used in Making Drill Pad

THOSE mechanics who like to make their own lathe accessories can provide themselves with a new drill pad whenever necessary by using the taper shank of a broken drill. A disk is brazed to the cut-off end of the drill shank as shown above. In this particular case the disk is of $\frac{3}{8}$ " plate, about 4" in diameter. A different size of disk could, of course, be used instead. When placed in the tailstock, the pad provides a square, flat surface on which to place the work being drilled and also protects the tailstock from possible injury.

Cutting Monogram Brooches from Thin Sheet Metal



A jeweler's saw with a fine blade is used to cut out monograms. The sheet silver or other metal is held on a V-block

MONOGRAMS for use as brooches and many other purposes can be made from sterling silver, monel metal, or almost any sheet metal of 18 or 20 gauge (B. & S.). They make particularly good gifts because present styles favor the use of monograms for decorative purposes on costumes and accessories.

Draw the design, actual size, on paper and paste it on the metal. Then use a jeweler's saw and a fine blade, preferably 2/0 or finer, to saw out the monogram. File off the sharp edges and buff. If a jeweler's saw is not available and the design is a simple one, it can be cut out in many instances by using a drill, snips, and files. However, a jeweler's saw should be one of the first tools purchased for decorative metal work.

The so-called "pin tong," joint, and catch may be obtained from a jewelry store or removed from a discarded brooch. Either soft soldering or silver soldering can be used to attach the joint and catch.—W. T. BAXTER.

Springs Clamp Thin Parts

COIL springs are useful gluing clamps for light, thin work. The springs are simply stretched until the parts being joined can be slipped between the coils. Several springs may be used on a single joint, if necessary. In the accompanying illustration, springs are being used in this way to repair a dog basket.—W. B.



RUST PREVENTIVE FOR TOOLS

[FORMULAS]

HEAT one part ordinary rosin and six parts lard slowly until the rosin is completely melted. Thin this to a flowing consistency with benzine. If $\frac{1}{2}$ lb. lard was used, for example, add about 1 pt. benzine. Apply sparingly to the steel, but first be sure the metal is clean and all rust spots have been removed with emery cloth or fine sandpaper. One of the leading manufacturers of chisels has found that tools rubbed lightly with this mixture will resist rust even when immersed in salt water and left for some time!

POPULAR SCIENCE MONTHLY SHOP DATA FILE

Dairyman Builds

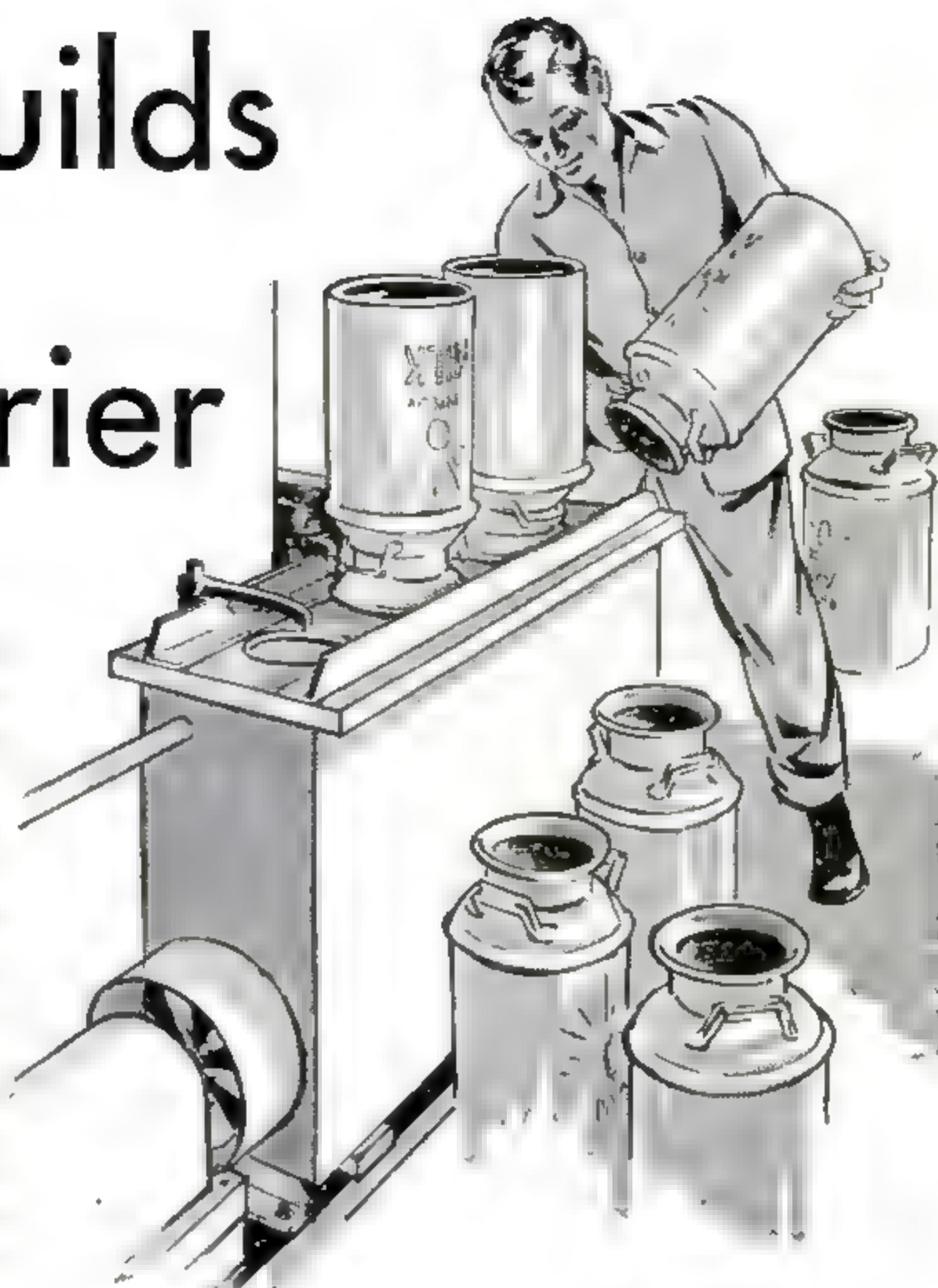
EFFICIENT

Milk-Can Drier

TO AVOID the multiplication of bacteria, the wise dairy farmer sees to it that his milk cans are not only clean but also thoroughly dry before they are filled. By constructing the milk-can drier illustrated, one Illinois dairyman who is mechanically inclined was able to save about \$200 over the cost of similar commercial equipment.

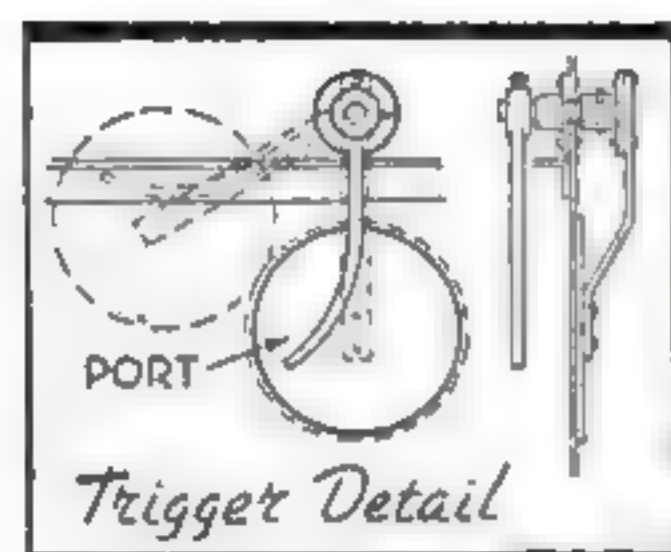
The drier box, which is located at the left end of the can-washing tank, is 24-gauge galvanized iron, 16" by 36" by 48". It contains about 116' of $\frac{1}{4}$ " galvanized pipe made up into four coils and connected by a common header to a $\frac{3}{4}$ " steam feed line. The coils are mounted on a $\frac{1}{8}$ " by $\frac{3}{4}$ " strap-iron frame fastened with $1\frac{1}{4}$ " by $\frac{3}{16}$ " bolts.

On top of the drier are $1\frac{1}{4}$ " angle irons to serve as guides for the cans and raise the cans sufficiently to permit circulation of air. Three cans are dried at a time. The operator places the first can on the forward or open port. The second can pushes the first along the guides to the second port, the shutter of which is opened by a trigger. The third can pushes the other two along, and by that time

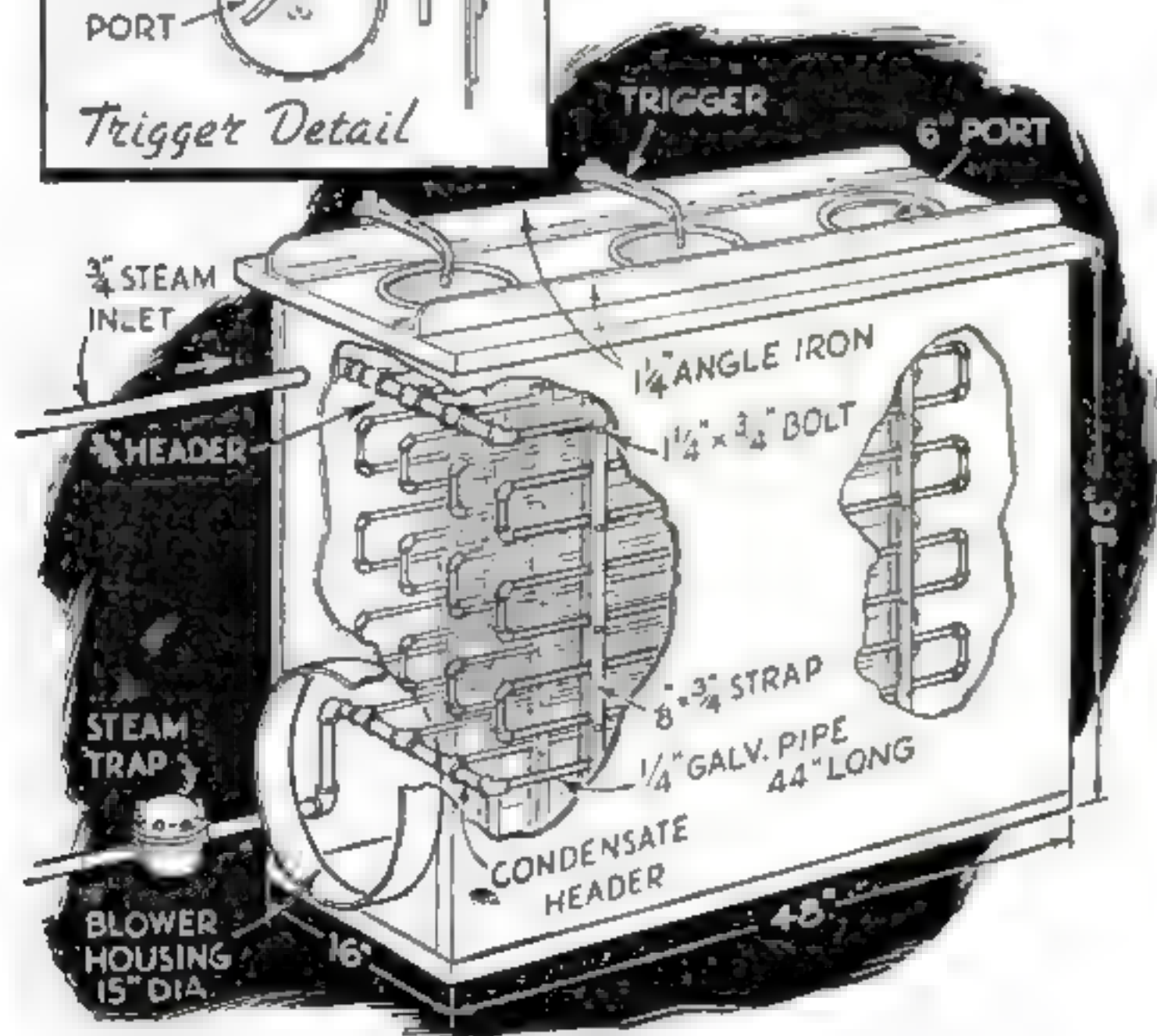


LIST OF MATERIALS

- 2 sheets 24-gauge galvanized iron, 36" by 96".
- 24' of $1\frac{1}{4}$ " galvanized angle iron.
- 4' of $\frac{3}{4}$ " and 116' of $\frac{1}{4}$ " galvanized pipe.
- 56 ells, $\frac{1}{4}$ "; 28 nipples, $\frac{1}{4}$ " by $2\frac{1}{4}$ "; 6 tees, $\frac{3}{4}$ " by $\frac{1}{4}$ "; 2 ells, $\frac{3}{4}$ " by $\frac{1}{4}$ "; 3 street ells, $\frac{3}{4}$ "; 1 steam trap, $\frac{3}{4}$ ".
- 36 bolts, $1\frac{1}{4}$ " by $\frac{3}{16}$ ", and assorted stove bolts. $\frac{1}{4}$ lb. rivets.



The drier, with walls partly broken away to show the coils, and, at left, how triggers work



the first can is dry and may be removed from the third port. The third or last port is the left one of the three as shown in the illustration above and the cut-away drawing at the left.

A 12" blower powered by a $\frac{1}{4}$ -h.p., 1,850-r.p.m. motor circulates the hot air into the cans. The motor is protected with a galvanized-iron hood to prevent damage by moisture and the splashing it is almost certain to receive, otherwise the dampness might cause it to become short-circuited and burn out.

The condensate from the steam at first was allowed to escape through a petcock, but too much steam was wasted, so a steam trap was added. The steam enters at the top of the coils, and the condensate escapes at the bottom through another $\frac{3}{4}$ " header and the steam trap.—S. V. LAYSON.

Upholstering

Final step—tacking the finished flounce to the chair framework through the seam on the underside



BUILDING the framework of a barrel chair as described last month (P.S.M., Oct. '38, p. 180) is simplicity itself, but the time and effort saved on the woodwork can well be spent in lavishing extra care on the upholstery.

A muslin foundation is first fitted to the chair curves. Spreading this foundation on a large table greatly facilitates the work of stitching the moss padding in place. Only the top half of the barrel, by the way, is padded. The foundation is then returned to the barrel.

Make the arm slips from a cardboard pattern marked from the arm rests. A 1" wide strip of cloth is used to join the two sections of each arm slip together. Close the openings in the slip foundation down the sides of the back and front below the arms with No. 2 tacks. Fit on the arm-slip foundations, pull down the inside of the arm slip snugly, and tack with the muslin foundation along the inside curve of the arm.

Overlay the arms with moss, padding the top only, and secure with loose stitching. Cover the arms and the inside of the chair with wool bat. Wool bat is also used outside of the chair to soften the upholstery. Fit snugly over this and over the back a finishing cover of coarse muslin. The chair is now "in the muslin."

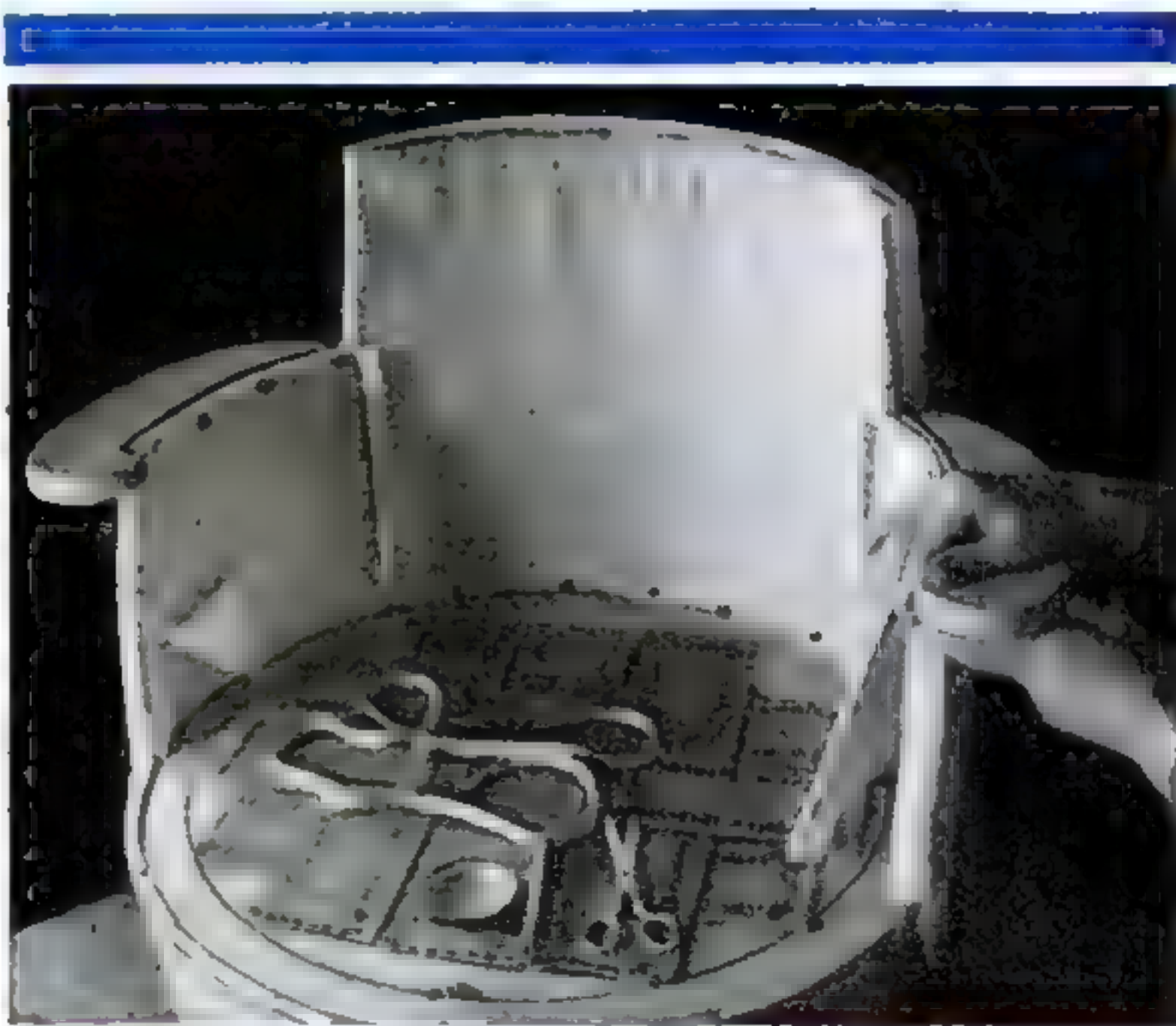
Use some of the outer upholstery material you have selected to cover the underneath part of the arms, following the

paper pattern as a guide, and fit snugly by using many pins. Baste this to the muslin cover.

Fit the inside and outside underarm sections, making a welt seam down the front of the section. A sketch shows the method of making welt seams. Cut the top arm covering with the aid of the paper pattern, but allow 1½" around it. The covering for both arms should be cut at once, on the bias, with the right sides of the cloth facing each other. The fullness about the outer end is gathered onto the 1" strip used as the covering for the welt cord. This top

"sleeve" is then tacked as shown in one of the photographs. Next turn the sleeve over the arm and draw the ends of the welt cord until the cover fits snugly. Tack the ends of the welt cord with No. 3 tacks to the chair at the back of the arms. It is not necessary to sew this covering in place.

The center back section is then fitted and basted to the muslin along the upper back. The seams joining the outside underarm sec-



Fitting a muslin foundation to the chair. Tucks are sewed flat when foundation is removed for padding

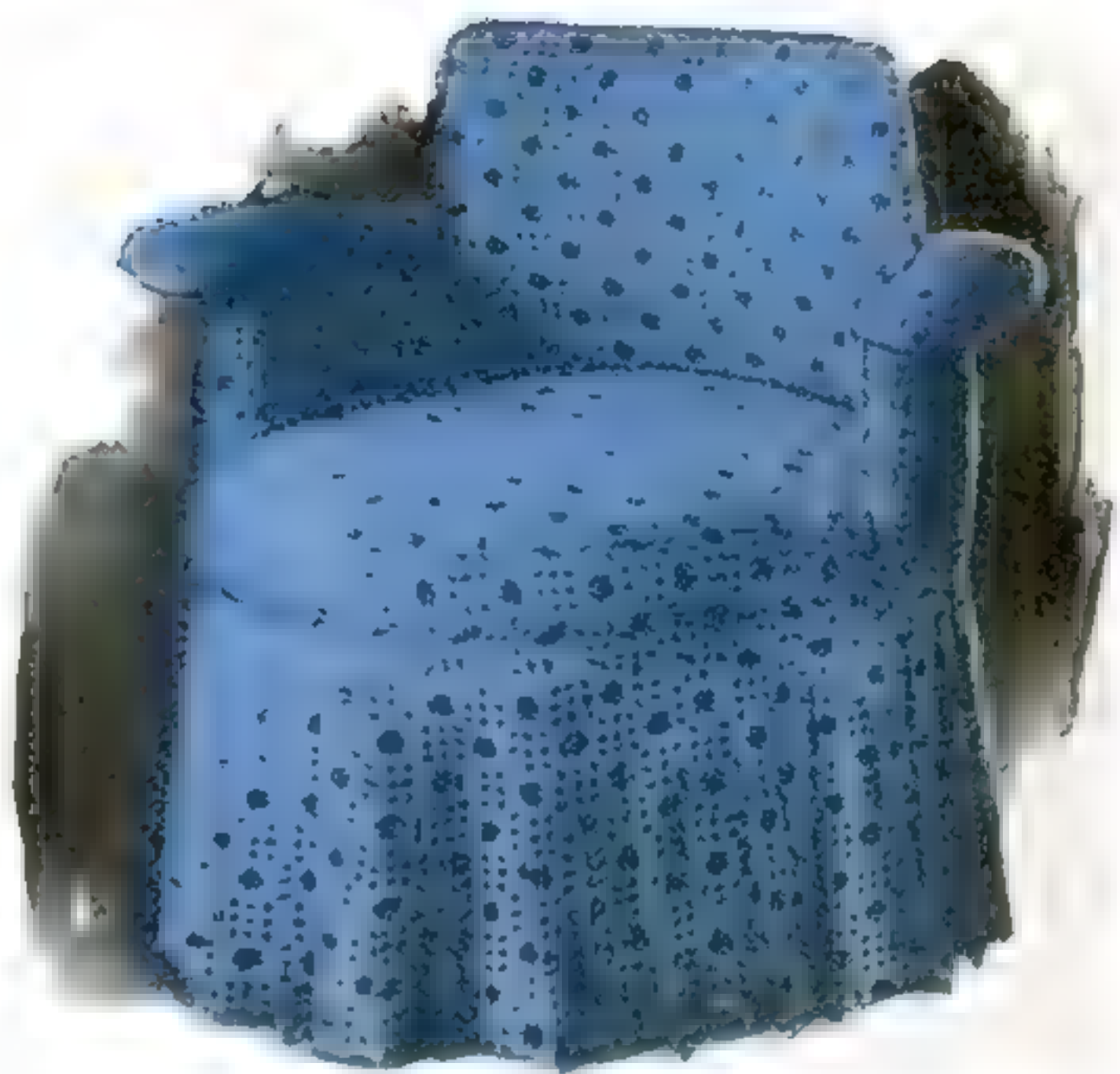
a BARREL CHAIR

tions are sewn so that they are inconspicuous.

Now the inside section is fitted. Remove it for making the welt seam around the top; then return it to the chair and pat and fit it in place, pinning as you work. The cord is pulled as in the arm covering to get a snug appearance. Tack firmly at the arms, and catch along the welt seam at the back with needle and coarse thread. Smoothing as you proceed, begin in the center and tack this section to the barrel at the seat line. Finish the two seams below the upper back section just as the corresponding outside ones were done.

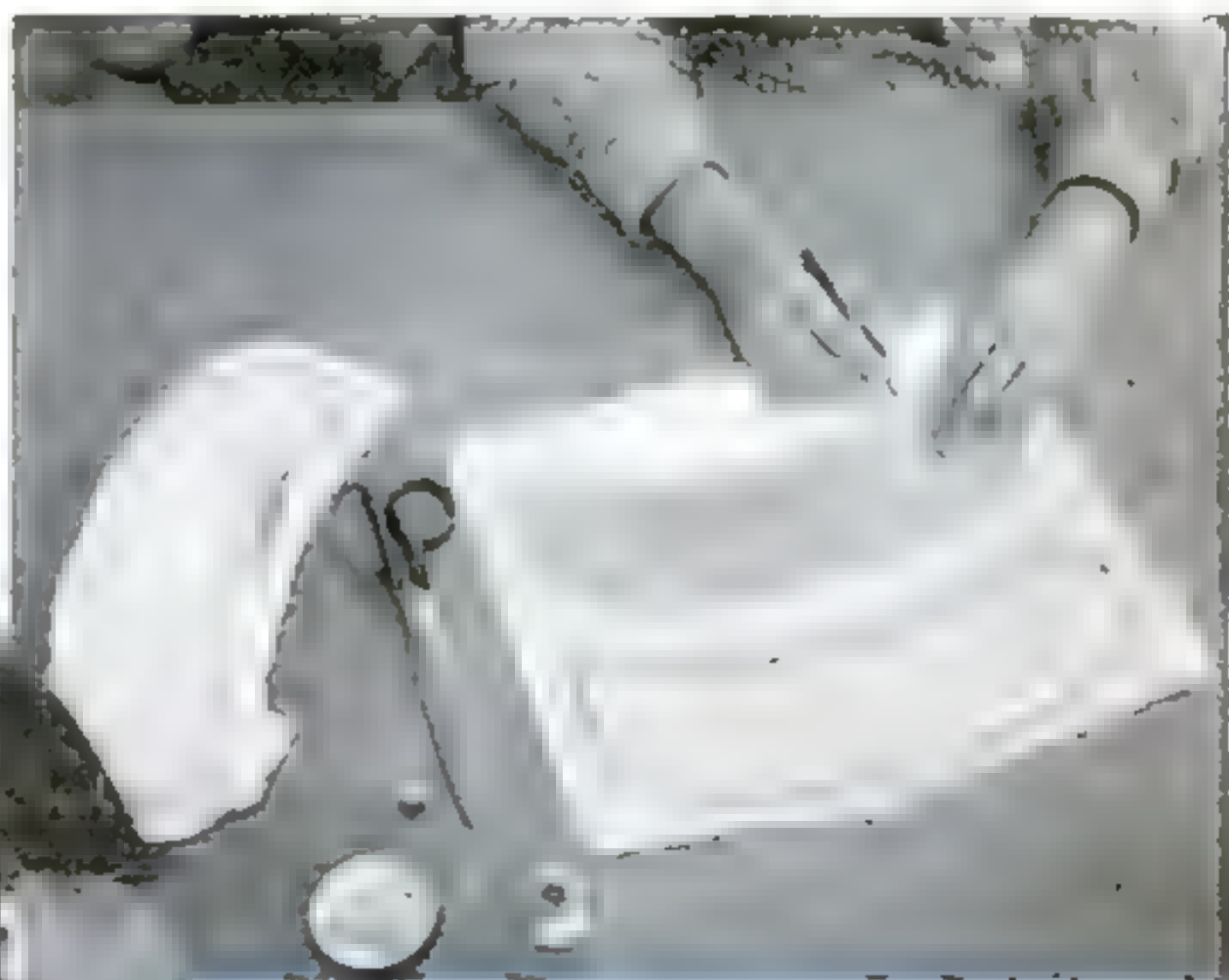
To make the box cushion, cut four disks 1" larger than the inside diameter of the barrel—two from muslin and two from the upholstery fabric. Cut boxing strips 2½" wide from each material of sufficient length to go around the circles. Make a muslin slip for the cushion, leaving a small opening for stuffing in the kapok. Close with whip stitching. Prepare the outer covering in a similar manner, only these seams are joined with a welt.

From the upholstery fabric cut a welt strip to go around the chair, and from the same material a piece three times as long for the flounce. Allow enough at the top of the flounce for a ½" seam and at the bottom for a small hem. Sew these pieces together, hem, and pleat onto the welt covering. Insert the cord and finish the seam by basting the covering over the cord. Press in the pleats.



Completed chair. The frame was cut from a barrel

Beginning at one side, pin the flounce to the upholstery so it just clears the floor, and continue pinning around the chair. Now close the flounce and draw the ends of the cord to the underside of the flounce, pull snug, and loop and tack firmly in place. Tack the flounce



Cardboard patterns are used to lay out muslin covers for the arms. A seam allowance of ½" is indicated by dotted lines

Sewing moss padding to the inside muslin foundation, which should be spread out on a large table to facilitate stitching





Arm slip in place, moss is being sewed on. The folds are the finished muslin slip, wool bat, and moss padding. At left, attaching covering to bottom of arm

onto the chair through the top seam, on the underside, up close to the cord.

If you want your barrel chair to look like a "professional job," be careful to pull the cords firmly to get that snug, well-fitting appearance. Also note in one of the photographs the muslin-covered wool padding over the front of the seat frame.

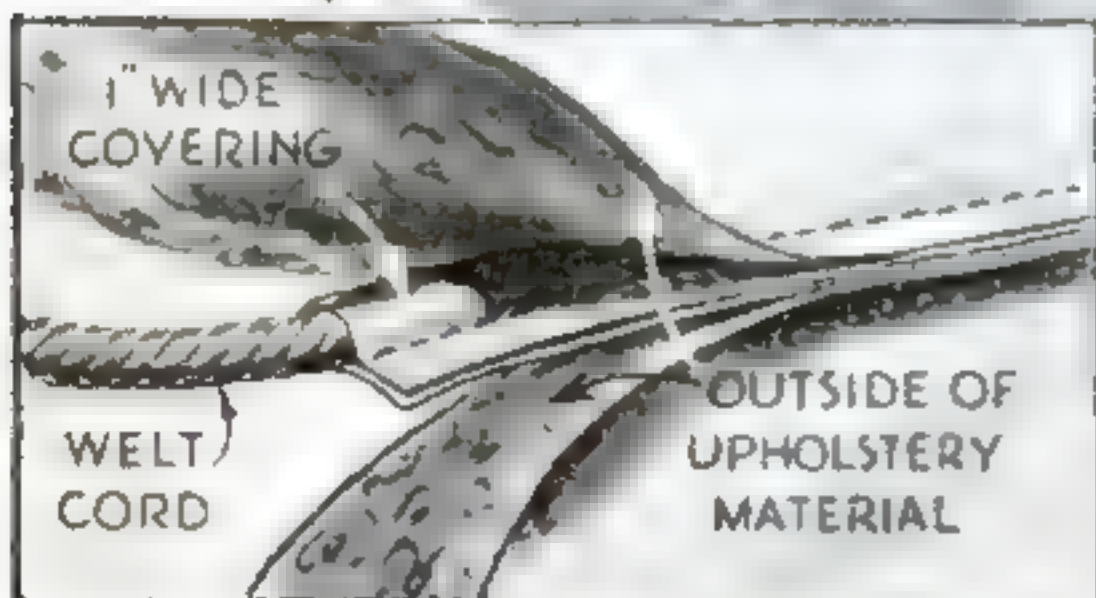
If you study the illustrations before starting to work, they will prove a great help in understanding the various steps.

MATERIALS for UPHOLSTERY

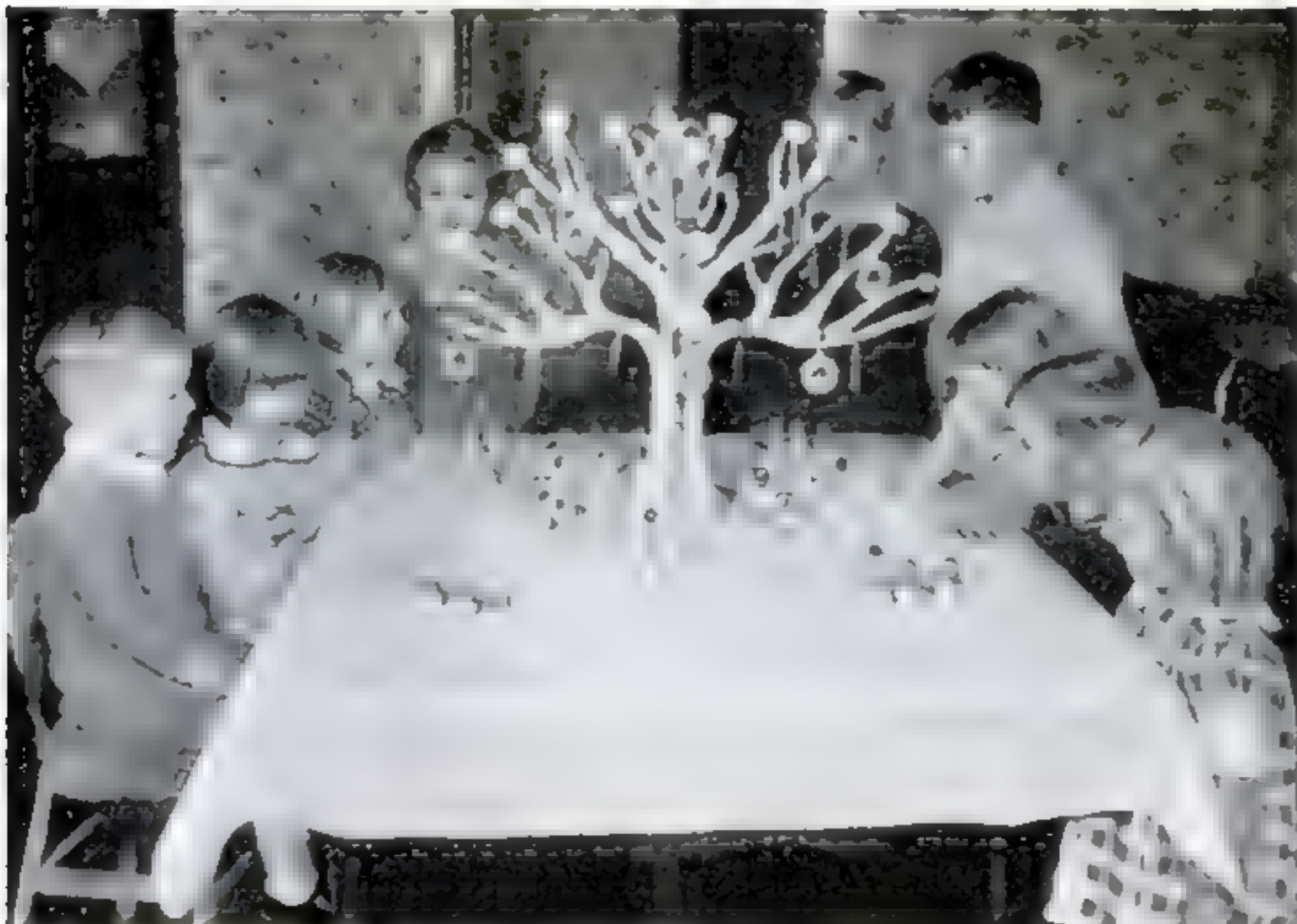
- 4 yd. 4" upholsterer's webbing.
- 3 yd. coarse muslin.
- 2 lb. hair or moss.
- 2 boxes tacks, Nos. 2 and 3.
- 1 small wool bat.
- 10 yd. upholsterer's welt cording.
- 6 yd. 36" covering—chintz, piqué, or print.
- 2 lb. kapok.
- 1 spool No. 24 sewing cotton and 1 spool No. 40 machine sewing thread.
- Grocer's twine to sew moss padding in place.
- 1 fine and 1 coarse upholsterer's needle.

As it would be quite difficult to sew along the curve, the upholstery is tacked to wood as far as possible. Underarm covering is in place

The permanent muslin cover is put on in sections. Note wool padding held by muslin to front of the seat frame



To make a welt seam, cover cord with material 1" wide and insert between seams of upholstery material. Right, fitting the inside of back



The tree is jig-sawed from heavy cardboard and covered with white icing and sugar



Fairy-Tale Tree of Sugar Plums Made for Children's Party

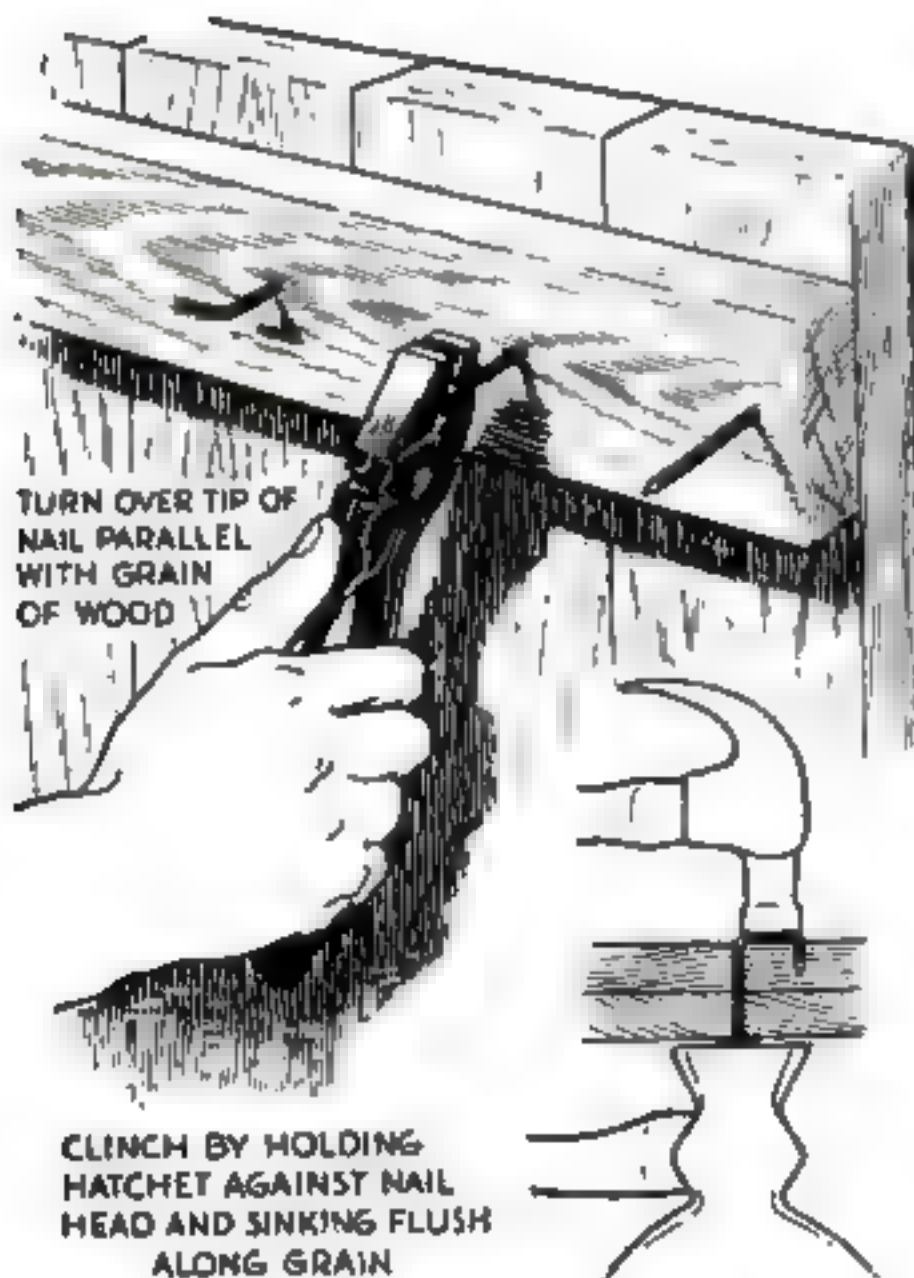
MOST children have heard the story of the sugar-plum tree, so there is no better stunt at a party than to provide a real sugar-plum tree. Two identical tree shapes are jig-sawed at one time from stiff cardboard or any available wall board. One piece is then slotted halfway down from the top, and the other halfway up from the bottom, so the two halves will slide together at right angles to each other. The tree will stand in a natural position when assembled and is easily taken apart when not in use.

White cake icing is applied, and colored confectioner's sugar is sprinkled over it while

still tacky to add the color. Marshmallows, jellied candies, and other soft candy serve as sugar plums. They can be slipped on quite easily if the ends of the branches are left somewhat sharp.

The chocolate cat that leaped around the tree and knocked off the sugar plums in the original story can be a china cat covered with chocolate, a pastry cat, or even a solid chocolate one. The dog that sat under the tree after he had chased the cat is a china dog. A number of lollipops with the sticks set in jellied candy form the fence around the tree. More novelties of a similar nature may be added.—D. C. MARSHALL.

Correct Way to Clinch Nails



Where screws are not practical, use this method to clinch nails

THERE is a right and a wrong way to clinch nails. Properly used, the clinched nail makes a satisfactory fastening for batten doors, shutters, or chests; for fastening cleats on various pieces of woodwork, or for securing two boards together to make a double thickness. The sketches show the correct method. When clinched in this way, the nails draw the wood tightly together and will never loosen. It is best to drill the holes slightly smaller than the nails.—W. W. WHEATLY.



Safety Pins Lubricated by Soap Pincushion

MANY trained nurses use a bar of soap for a pincushion because the soap lubricates the pins so they slip easily through coarse or resistant materials. The idea is especially valuable in the nursery, where it saves time and energy.

Alligator Toy Has Flexible Spine

THIS amusing toy, the "twistum 'gator," is made of wood segments glued to a heavy canvas core or spine about 2' 6" long.

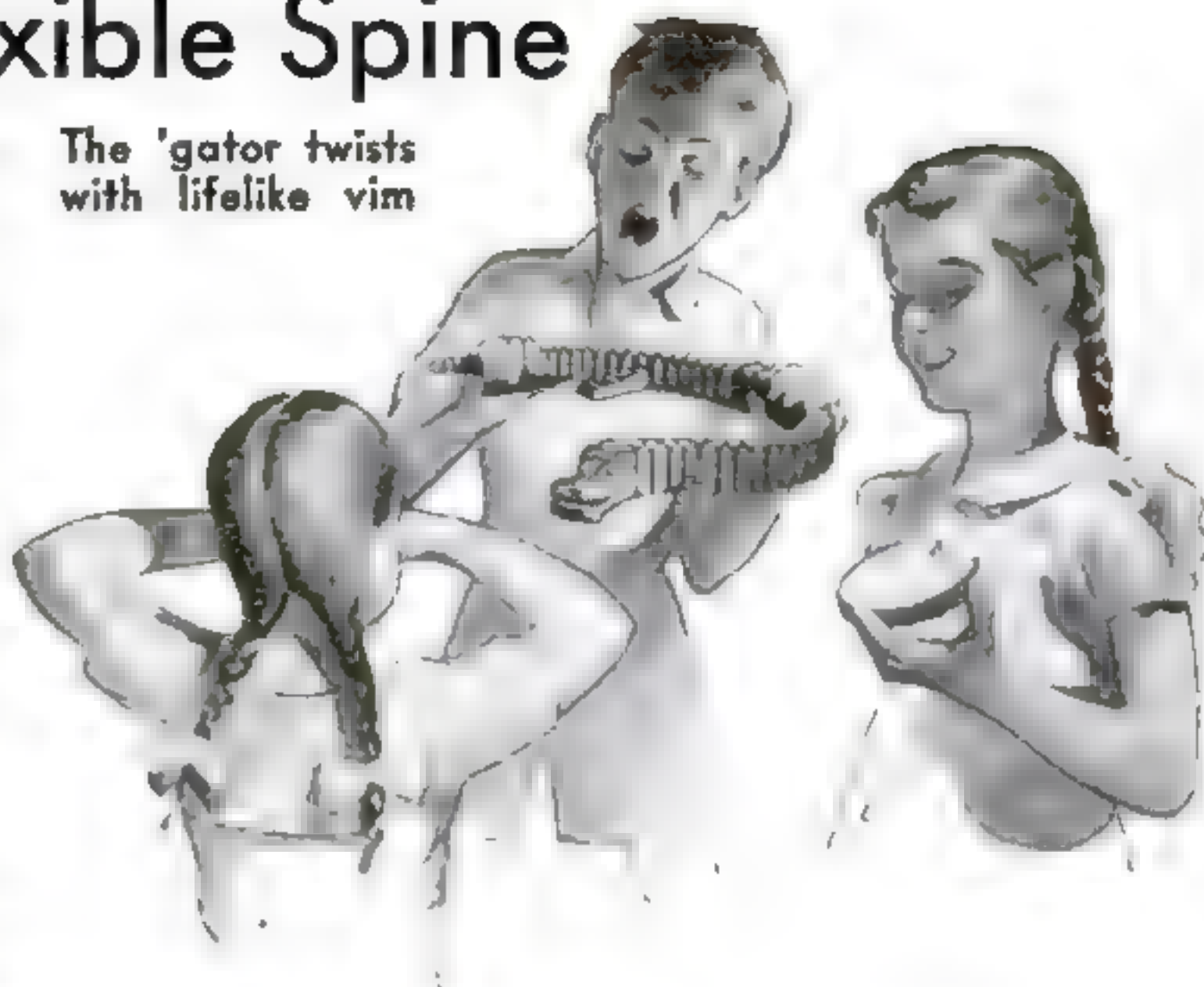
After cutting the canvas, make two identical pieces for the head with coping saw or scroll saw and glue these opposite each other on the canvas. Then saw, or have sawed, a strip $\frac{3}{4}$ " by $\frac{3}{4}$ " by 5' or 6' with the saw table top tipped to an angle of about 15 deg., so that the two opposite edges of the strip are on an angle as shown. Cut another strip or two $\frac{5}{8}$ " by $\frac{3}{4}$ " by 6', also beveled on two opposite sides to a 15-deg. angle.

With knife or saw, cut the end of one of the $\frac{3}{4}$ " strips to a sharp edge, like the roof of a gabled house. Cut this end off 3" long, point the stick again, and repeat. Glue these pieces opposite each other close against the head with the $\frac{3}{4}$ " face fastened to the spine.

The remaining body

Wooden segments are glued to the sides of a spine of canvas

The 'gator twists with lifelike vim

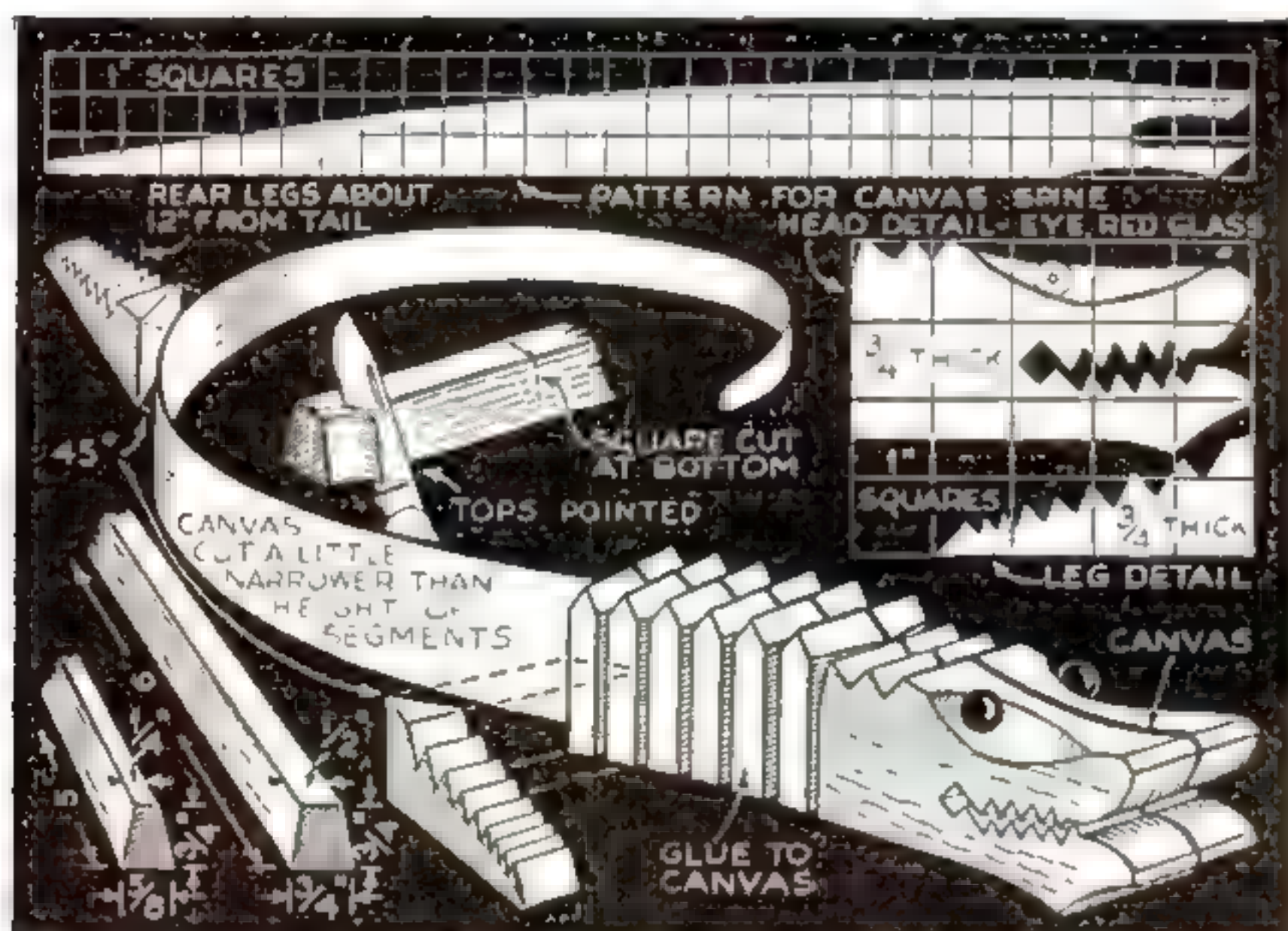


work is a repetition of the process. The first six pairs are about 3" long, then taper off slowly and gradually a little more than $\frac{1}{16}$ " at a time until at the end of the tail they are only about $\frac{1}{2}$ " tall. For the first dozen segments use

the $\frac{3}{4}$ " strip; for the remainder, use the $\frac{5}{8}$ " pieces. Near the tail, trim off the outside faces so as to get a gradual taper to the tail. The segments for the last inch or so may be carved in a single piece.

The legs are solid saw-toothed strips cut at an angle of 45 deg., and each is glued and nailed to two segments of the body. The body is painted green with red on the teeth, and the eyes are red beads.

Any kind of wood will do for the 'gator although soft wood is easier to whittle.—R. H. JENKINS.



Layout for the spine and how the wooden parts are added

Holding Small Drills in Chuck on an Arbor

WITH drill chucks of the type that screw directly onto a threaded spindle, the jaws sometimes cannot be completely closed because the arbor threads are too short. This can be remedied by slipping a short rod into the back of the chuck.



Trousers Hanger Used as Clamp

IF ALL available glue clamps are in use, an idle trousers hanger will often serve the purpose of holding small parts together. It has the advantage of being quickly adjusted with one hand, and the bars apply pressure in a straight line over a considerable area.—W.C.W.





Guild Achievement Awards



TO BE GIVEN ANNUALLY

SO SUCCESSFUL was the first achievement contest of the National Homeworkshop Guild (see P.S.M., Sept. '38, p. 62), that POPULAR SCIENCE MONTHLY will hereafter make the awards annually. Three clubs will be selected each year and presented with beautiful silver plaques for outstanding accomplishments in the fields of civic activities, club programs, and craftwork. Although the plaques themselves will be of the finest quality and suitably engraved, far more is involved than their mere value because each represents the greatest national distinction that can be attained by a home workshop club.

Awards will be made on the following basis: 1. To the club accomplishing the most in the way of civic activities and community enterprise. 2. To the club arranging the best programs for its regular meetings. 3. To the club offering the most outstanding piece of craftwork made by one of its members. Besides the plaque, which in each case becomes the permanent property of the club, a special sterling silver craftwork medal will be awarded to the individual member whose project is selected as the best in the third division.

New clubs as well as old are invited to enter the competition. All that each will have to do is to submit a complete statement of what it has done of service to its community; or of what its programs have consisted; or, in the case of craftwork, to present photographs and a brief description of the project the members believe to have been the best made during the six-months contest period—from October 1, 1938, to April 1, 1939. A club may enter one, two, or all three divisions, but can

receive an award only in one. In case of ties, each tying contestant will be awarded a prize equal to that tied for. No club having won an award this year is permitted to compete in the same division in which the award was won, but it can enter either or both the other divisions.

Detailed regulations are contained in the monthly bulletin being sent to club secretaries. All entries must be received at headquarters of the Guild, 347 Fourth Avenue, New York, on or before May 1, 1939.

This contest is only one of the ways in which the Guild is actively promoting the interests of its affiliated clubs. Bulletins, job sheets, program suggestions, and other helps are sent regularly to club secretaries. If there is no club in your neighborhood, send for Instruction Bulletin No. 16A which explains how you can start a club and enjoy the Guild's many free services.

National Homeworkshop Guild

347 Fourth Avenue, New York

Please RUSH complete information on how I can start a club and become affiliated with the National Homeworkshop Guild. I don't want to miss any of the free services, contests, and other opportunities available to Guild members. I am inclosing a large (legal size) envelope, self-addressed and bearing a three-cent stamp, for your use in sending this material.

NAME.....

ADDRESS.....

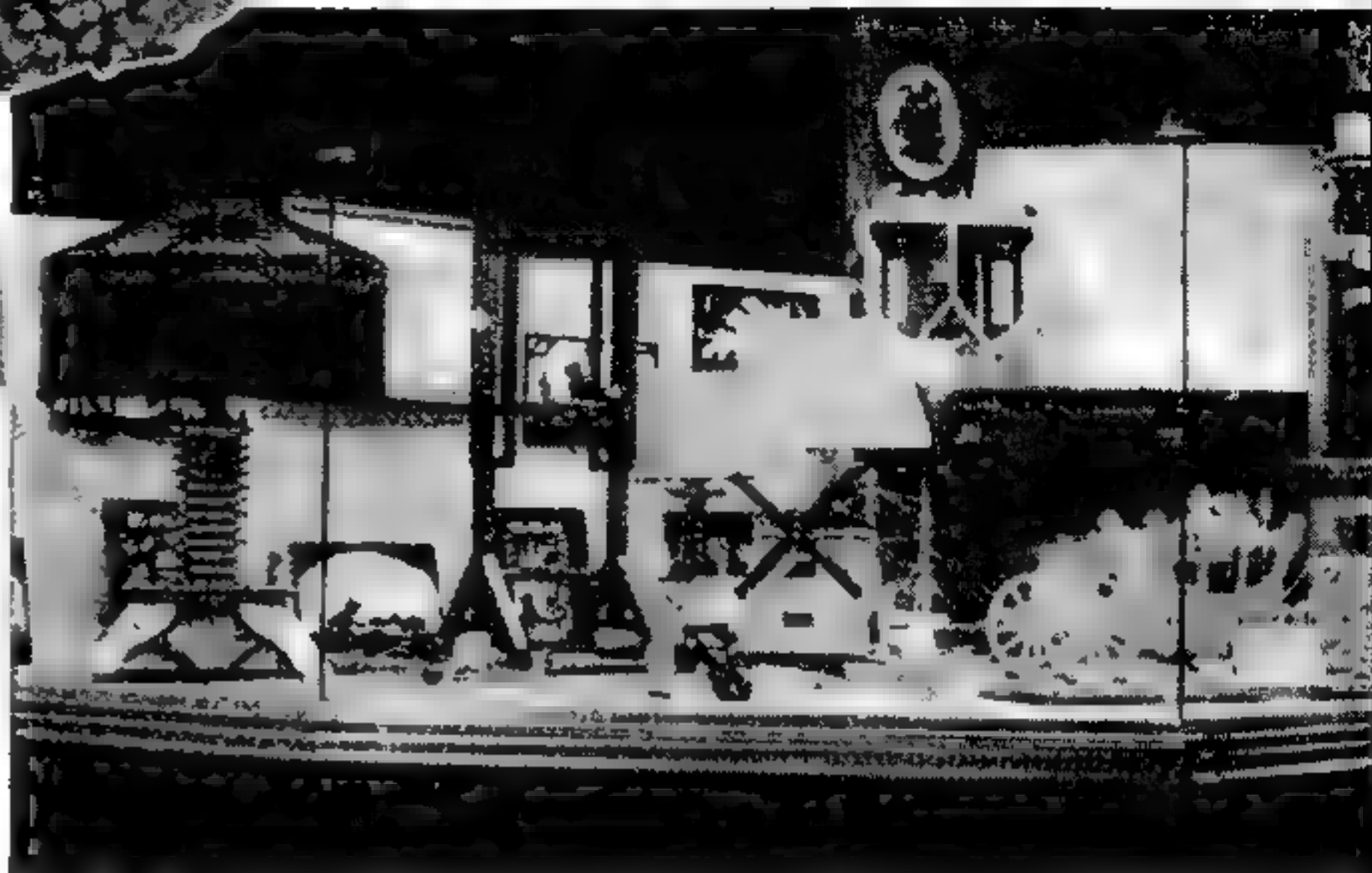
CITY.....STATE.....

Home Workshop Clubs

CRAFTWORK ACTIVITIES RANGE



Fruit bowl carved by A. O. Stenwick, of the Red Wing, Minn., club. At right, window exhibit of the Busy Bee Homeworkshop Club, Cornwall, Ont., Canada



SIX turned bases for lamps are being designed by the *Fairmont (W. Va.)* Homecraft Club at the request of a local electric-utility company, which will sponsor a contest for manual arts classes this fall. The bases will be used as judging standards in a competition to promote the "better light, better sight" idea among school children. The students will be provided with kits and asked to make scientifically designed lamps.

The Town Hall Homeworkshop Club, *Ottawa, Ill.*, plans to reclaim a replica of a pioneer log cabin that has been damaged by flood. It was built in 1931 for the town's centennial.

These are only two of the many unusual projects being undertaken by affiliates of the National Homeworkshop Guild. The fall season opened with a bang, and clubs everywhere are starting the most ambitious programs in their history.

Recreation is just as important as an evening of woodworking, according to the Timber Craft Homeworkshop Club, *New Bedford, Mass.*, which has installed a table-tennis table, a dart target range, and a race horse game in the club workroom. The latter game was designed and built by the president, Charles Jeglinski. A photographic department may be added soon.

New officers of the *Preston (Ont., Canada)* Homeworkshop Club are Harvey Goos,

president; Stan Schoenan, vice president; Harry Adams, secretary-treasurer; Arthur Underhill, librarian; Howard Starr, Clarence Schneider, and Harvey Eagle, governors. An exhibition was held recently, and another one will be given at the Galt Fall Fair.

Stuart D. Pike won first prize in the monthly contest of the *Ware (Mass.)* Craftsman Guild. Henry J. McCarthy and John E. Haley tied for second place. Albert M. Antaya received third prize. Secretary Stephen J. Milos donated the prizes, which consisted of tools. At each meeting the members exhibit completed articles and explain the construction. During September the club had displays in two store windows.

Three thousand persons attended the fifth annual exhibition of the North Shore Craftsman Club, *Waukegan, Ill.* There were exhibits by thirty-five members including scrollwork by Alex Osling; display of 282 kinds of wood by Charles Crapo and James Stout; end table and lamp, Charles Stone; model engines, Leslie Bistock; model ships, C. W. Clark, Irwin Lamson, and James Stout; model airplanes, boys outside the club; lamps, Paul Griffin; smoking stand, E. C. Johnson; wood carvings, R. E. Pierce and David Lungren.

R. R. Long, secretary of the *Galesburg (Ill.)* Homeworkshop Club, reports: "Our annual exhibit, which was held in the window of a furniture store, showed a marked improvement in workmanship and received many fine comments from the public. We had thirty-two entries. Prizes having an agree-

Undertake Unusual Projects

FROM DESIGNING LAMP BASES TO RECLAIMING A CABIN

gate value of \$116.60 were awarded." A baked ham dinner was given the members and their families recently at the club's expense.

Elated at winning the national award for civic activities (see P.S.M., Sept. '38, p. 62), the *Jacksonville (Fla.)* Homeworkshop Club sent a photograph of the plaque to each member . . . New officers of the *Fall River (Mass.)* Homecraft Club are Manual Estrella, president; W. G. Sweeney, vice president; Clifford Schlemmer, secretary;

Bernadin Lafond, treasurer; Clovis Saucier, librarian . . . The Staley Handicraft Club, *Decatur, Ill.*, received an excellent write-up in a recent issue of "The Staley Journal."



Members of the Lewis-Clark Homeworkshop Club of Lewiston, Idaho, and Clarkston, Wash.



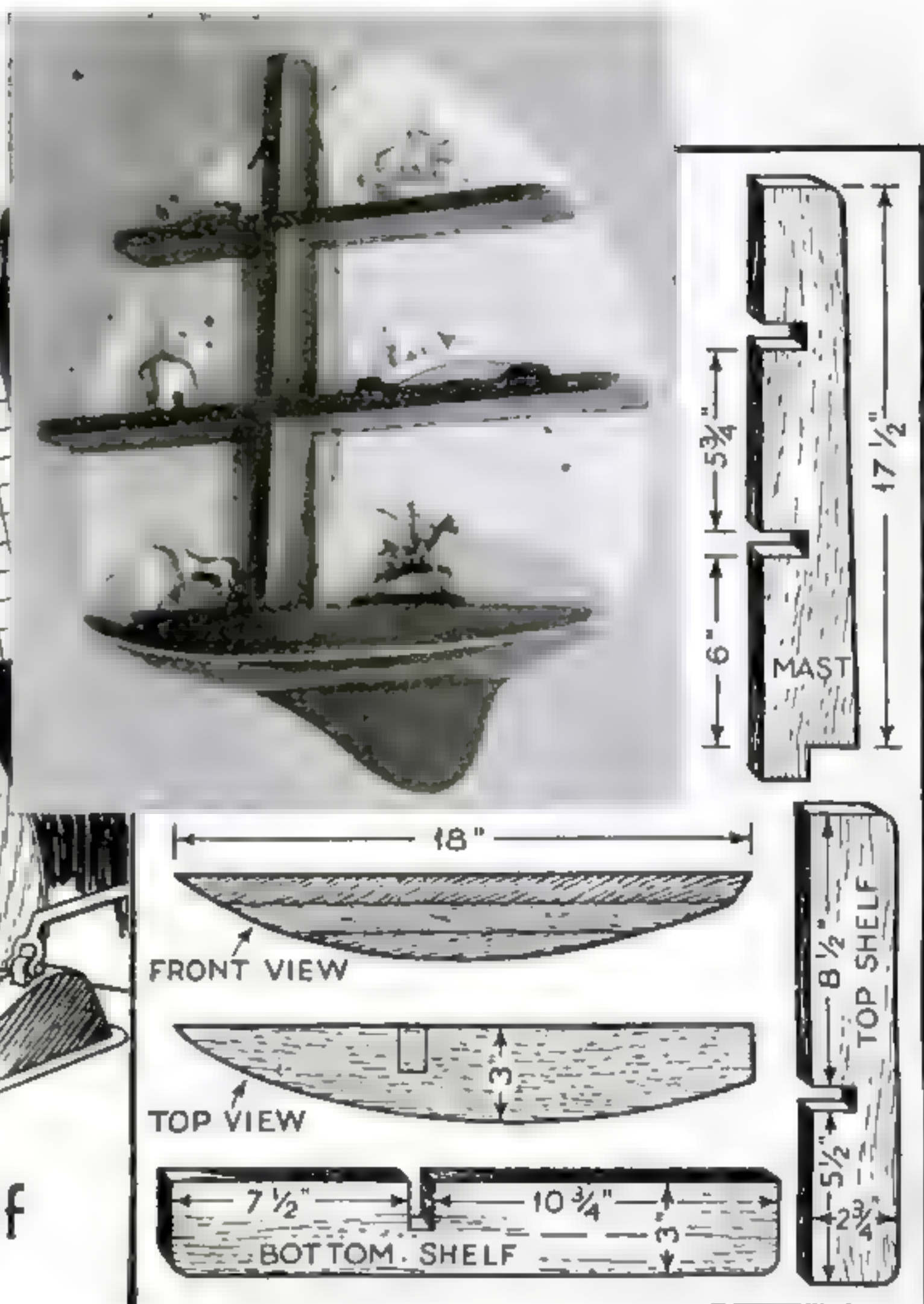
Three thousand persons attended the fifth annual exhibit of the North Shore Craftsman Club, Waukegan, Ill.



Decorative Whatnot Shelf Shaped Like Sailboat

THIS simple but decorative whatnot shelf can easily be made in an evening. It was designed and built by Charles Jeglinski, president of the Timber Craft Homeworkshop Club, New Bedford, Mass.

Cut the silhouette of sail, boat, and keel from $\frac{1}{4}$ " plywood. Make the shelves and mast from $\frac{3}{4}$ " or 1" pine and notch them to fit together as shown. Glue together three 1" pieces of pine for the hull, cut roughly to shape on the band or jig saw, and finish on



the disk sander. A solid piece 3" by 3" may, of course, be used instead. Make a notch for the mast. Then assemble with glue and brads.

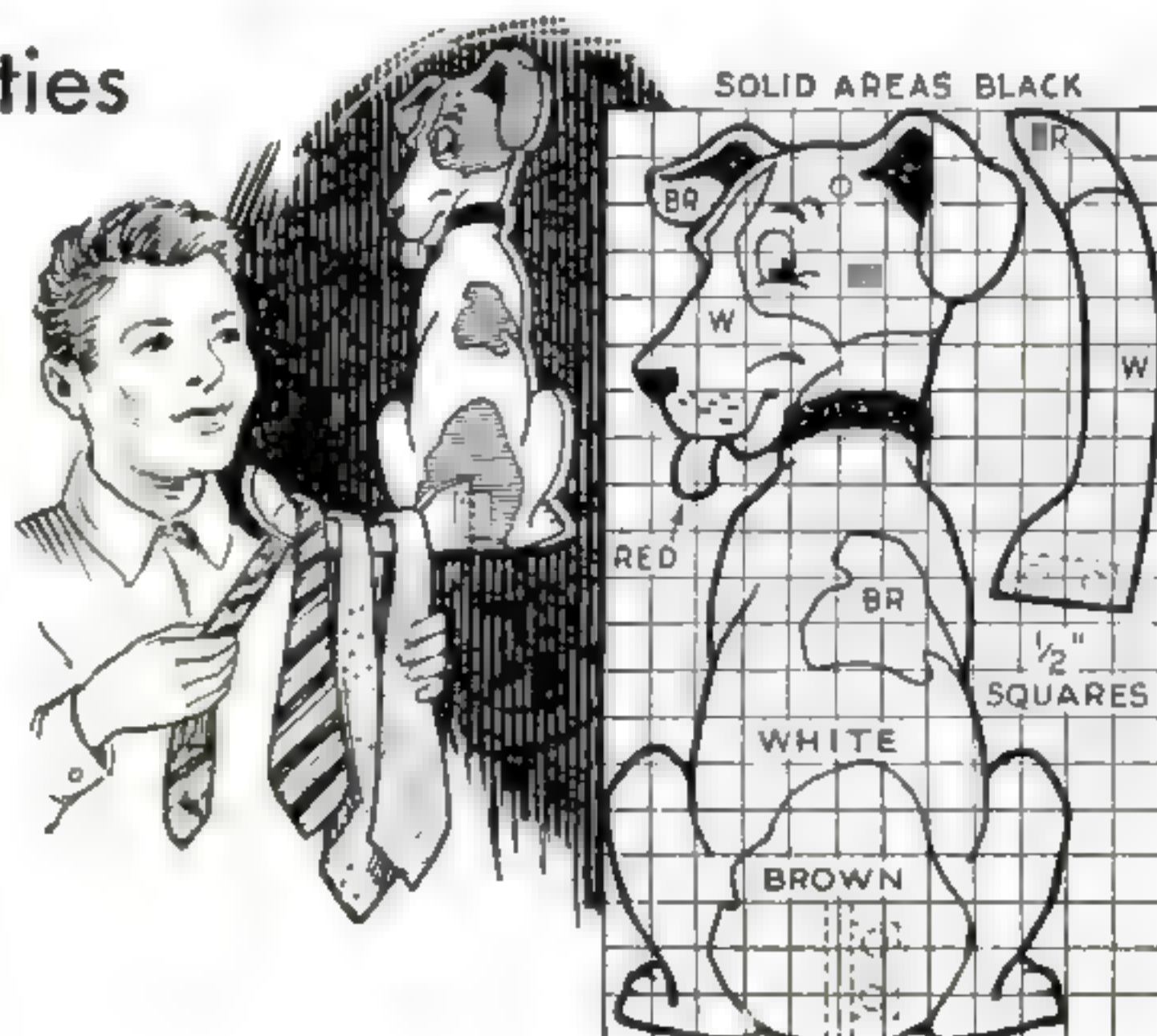
Use red enamel on the keel, the boat up to the water line, and the edges of shelves and mast. Paint the sail white. Apply a maple stain to the flat sides of mast and shelves, deck, and side of hull. Glue a strip of glossy white paper to the hull to indicate the water line; this is more satisfactory than trying to paint a white stripe.

Jig-Sawed Pup Holds Neckties

ONLY a piece of $\frac{1}{4}$ " plywood 6" by 10", a small hinge, and some paint are needed to make this novel necktie rack for a boy's room. It was designed by Donald E. Bush, of Meridian, N.Y., and submitted in a contest of the National Homeworkshop Guild. Cut the dog to shape on a power jig saw or with a hand scroll saw, attach the tail to the body with a hinge, and paint the parts as indicated.

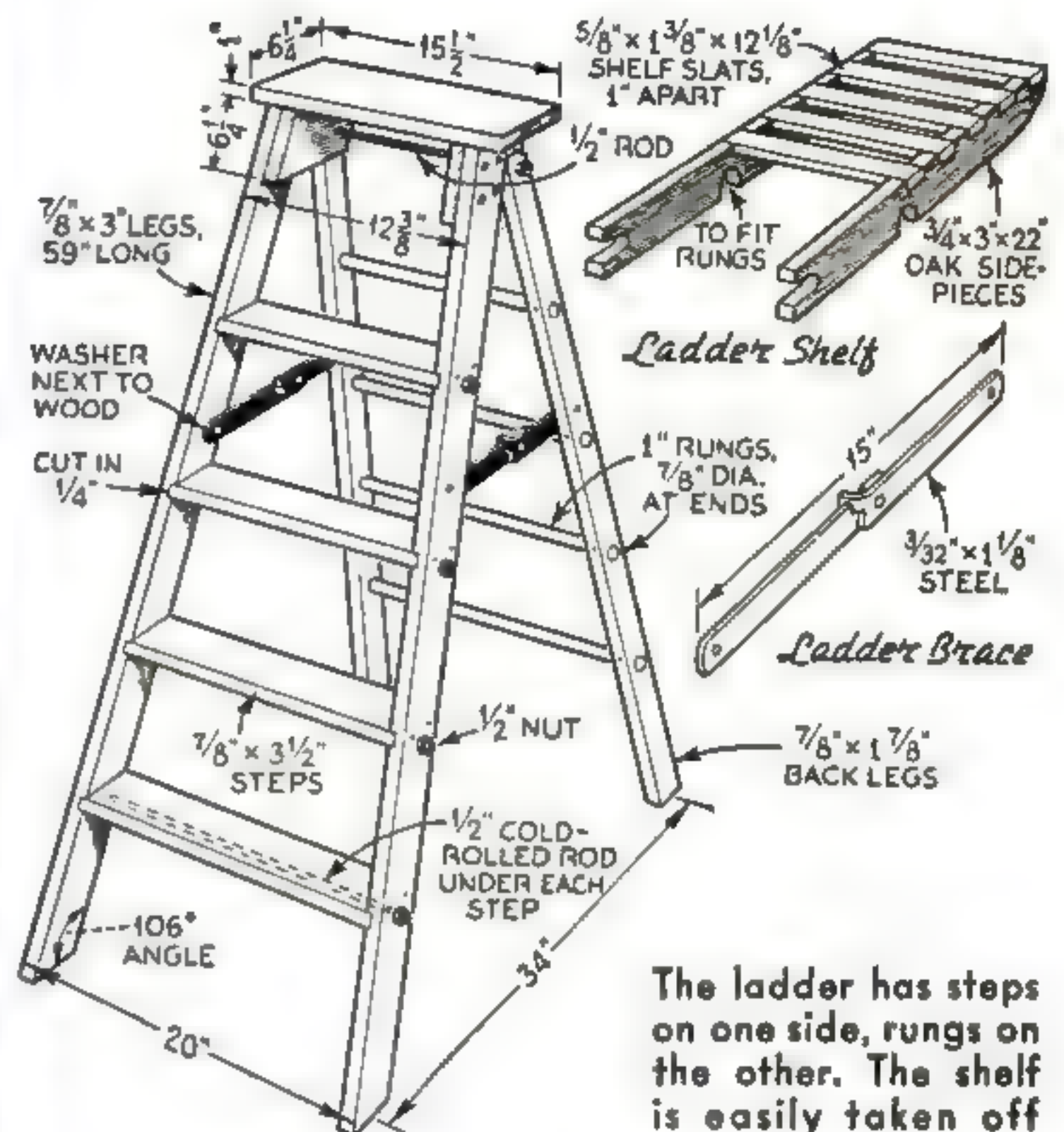
Fine Steel Wool Cleans Wall Board

SOILED spots on wall board, caused by handling in the course of construction, may be removed without damaging the surface by rubbing them gently with fine steel wool.—E.B.





Double-Duty Stepladder Saves Painter's Time



The ladder has steps on one side, rungs on the other. The shelf is easily taken off

The platform board slides through from either side

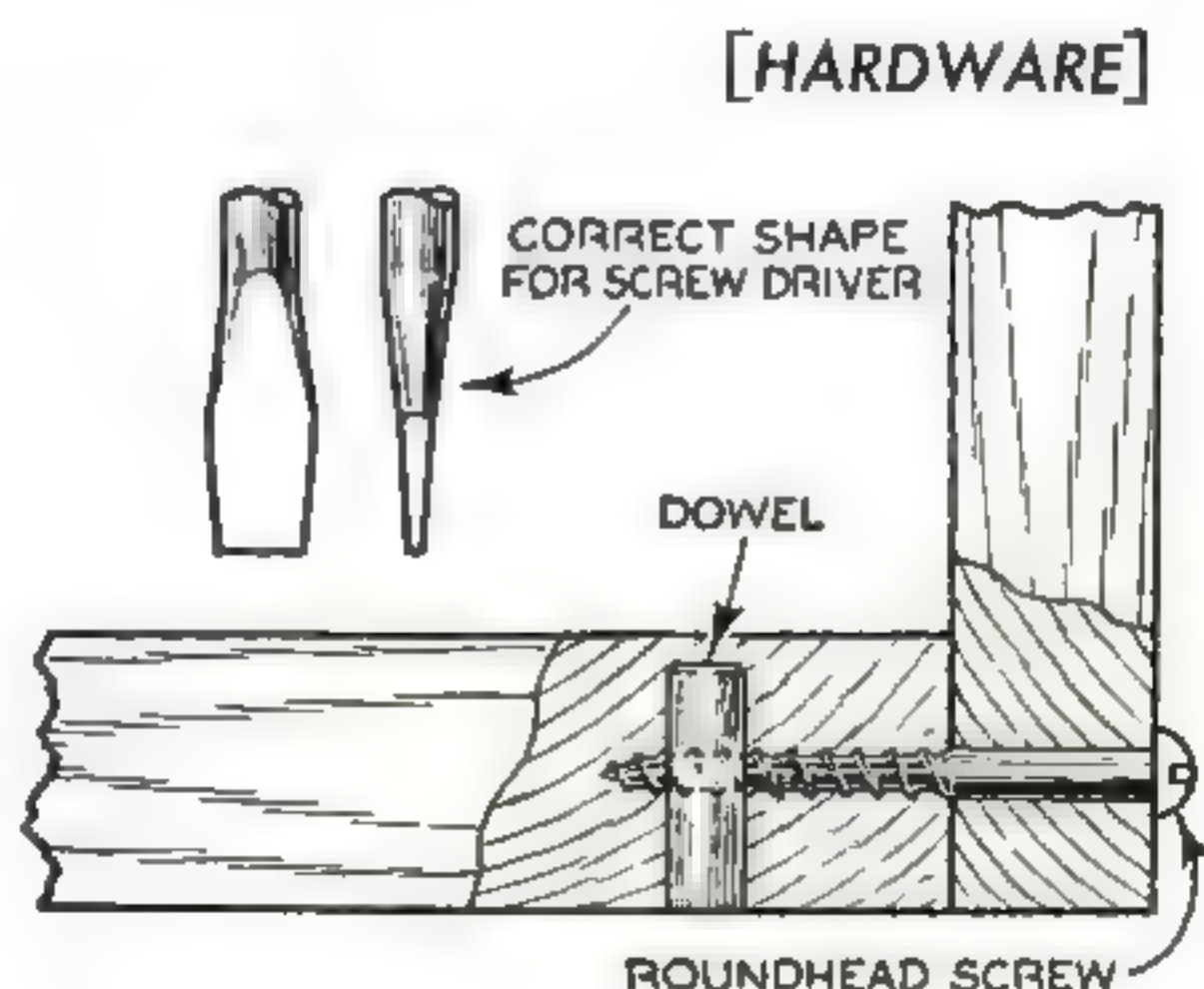
DESIGNED by a painter and paper hanger, this heavy-duty stepladder can be ascended from both sides. It has steps on one side and rungs on the other. This feature permits a platform board to be drawn through the ladder unobstructed by any of the usual cross bracing. When a long stretch of wall or ceiling has to be papered, the lad-

der can be used as the central support of a long board platform. Another advantage is the removable shelf, which can be laid aside when not required or when it is desired to use the top rung to support a plank.

The ladder can be made from any light, strong wood, except the shelf, which should be of oak or other hardwood, and the rungs, which are turned from straight-grained hickory.—O.R.S.

DRIVING WOOD SCREWS

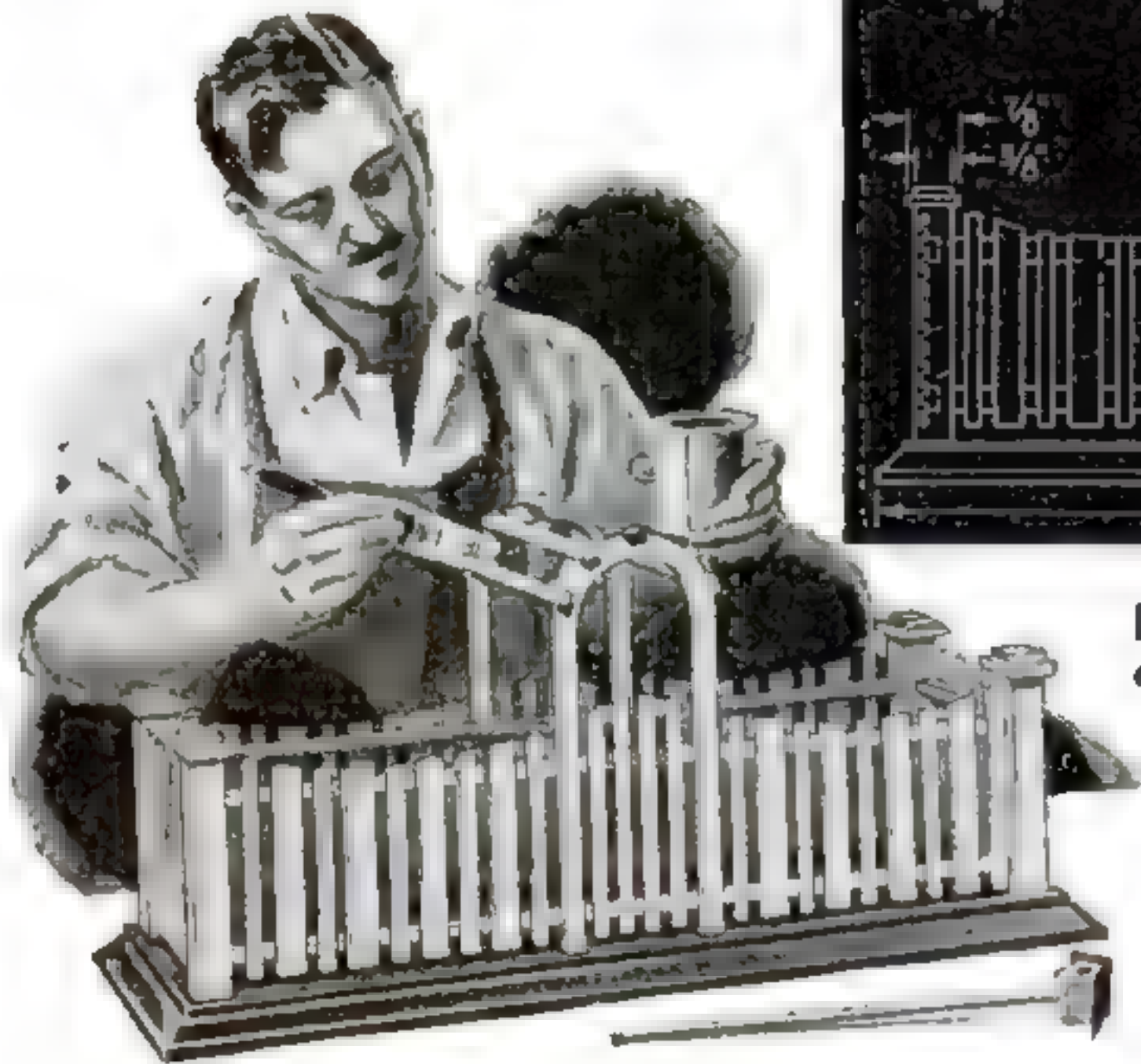
USE a screw driver with square end and flat sides (not rounded, worn, or chipped). It should fit snugly in the slot, and the end must not be wider than the head of the screw. Never force a screw until it twists off because the imbedded part is difficult to remove. In hardwood, it pays to drive an iron screw of the same size before attempting to insert a brass screw because the latter is more likely to twist off or break at the slot. When several screws are inserted where they will be conspicuous, as in attaching hardware, try to leave the slots aligned vertically or horizontally. Screws do not hold well in end wood. To make such joints strong, insert a dowel



through which the screw can be driven as shown. (See also the shop data file on "Wood Screws," P.S.M., Oct. '38, p. 186.)

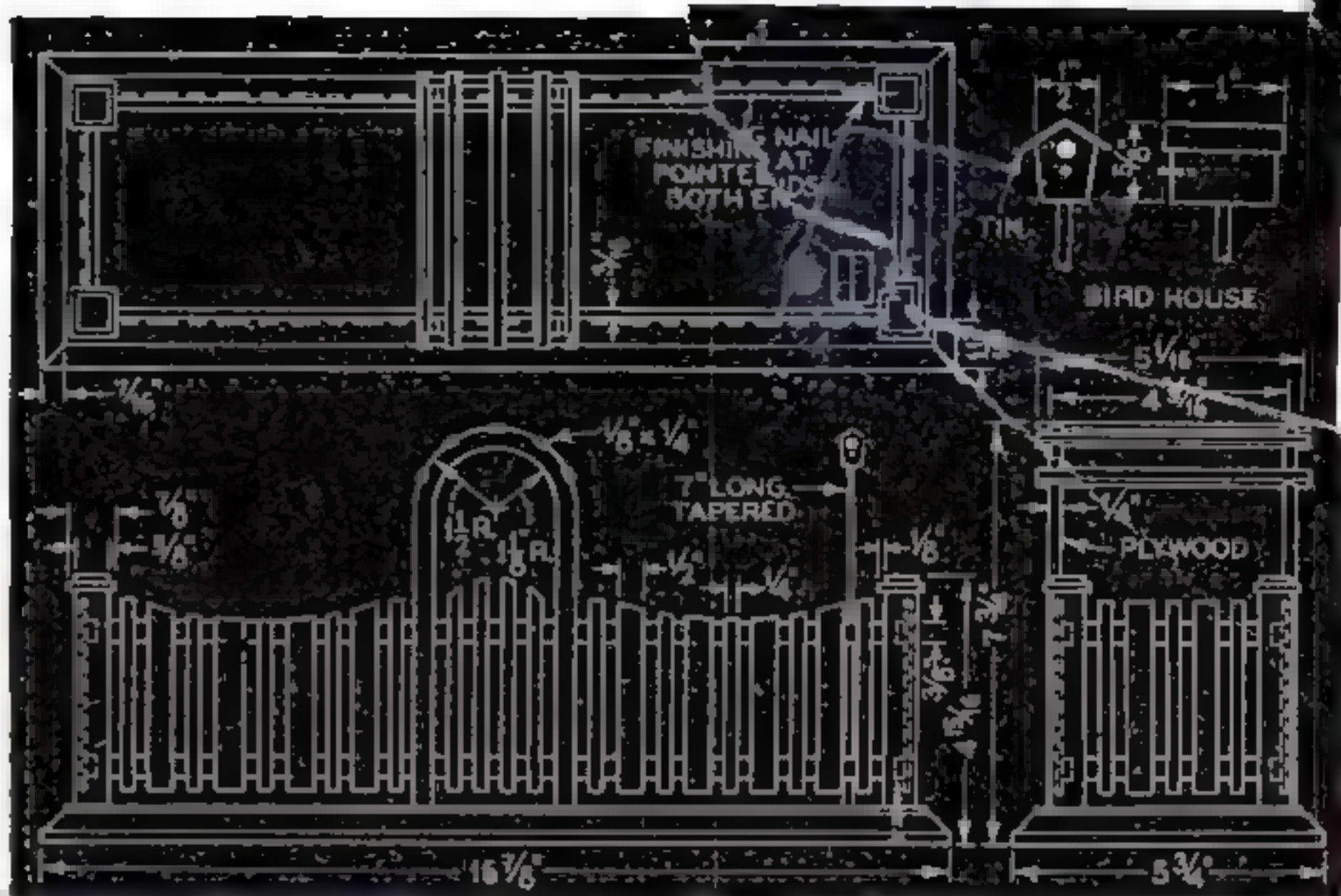
POPULAR SCIENCE MONTHLY SHOP DATA FILE

Fence-and-Trellis Design for Small Window Garden



A MINIATURE fence and trellis form the decorative features of this window garden. To the craftsman looking for extra pocket money, the design has the advantage that it appeals to women and sells readily.

Softwood is used throughout. The rails are 3/16" by 3/8" basswood, the pickets of any 1/16" veneer. The pickets are glued to the rails. The arched trellis, of 1/4" three-ply fir, is tacked to the rails with 1/2" No. 20 brads. The corner posts are of basswood, and the base may be sugar pine or cypress. Butt joints are used, reënforced where necessary with double-pointed nails and glue. A 3" by 3" by 14" galvanized pan can be inserted and filled with earth, or individual small pots may be placed in the pan. If tools are not available for making the pan, two small bread pans



Drawings of window-box construction. Left, adding a few finishing touches to the fence and trellis

from a ten-cent store will serve the purpose.

The bird house is cut from a solid piece of wood and the tin roof cemented in place. A small round black spot painted on the end of the house serves as an entrance.

Fence, trellis, and bird house are painted white, the base black, and the tin bird-house roof, red. The bird-house post is merely pushed into the earth.

—A. V. BALUKA.



Two bread pans can be used to hold soil for the plants

Alcohol Speeds Sponge Drying

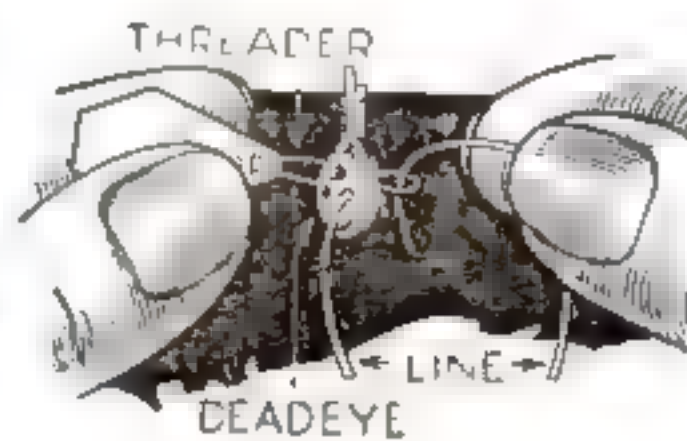
RUBBER sponges used to clean wall paper have to be washed frequently, but take time to dry. To use the sponge immediately, wring it out, form into a roll, and soak with denatured alcohol. Then wring it out again.



Pouring alcohol over a sponge so it will dry

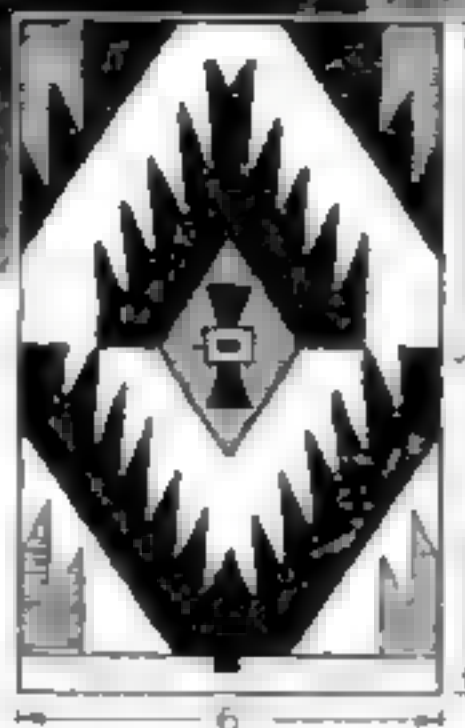
Aid for Rigging Models

IN RIGGING ship models, the most practical way I have found to thread blocks, deadeyes, and other very small parts is with the aid of an ordinary needle threader of the type illustrated. Recently I used this method to lace the wooden sails of a 6-in. model of a yawl to the masts and spars, the holes having been made with a No. 70 drill. Threader should have fine steel wire.—G. R. FOWLER.

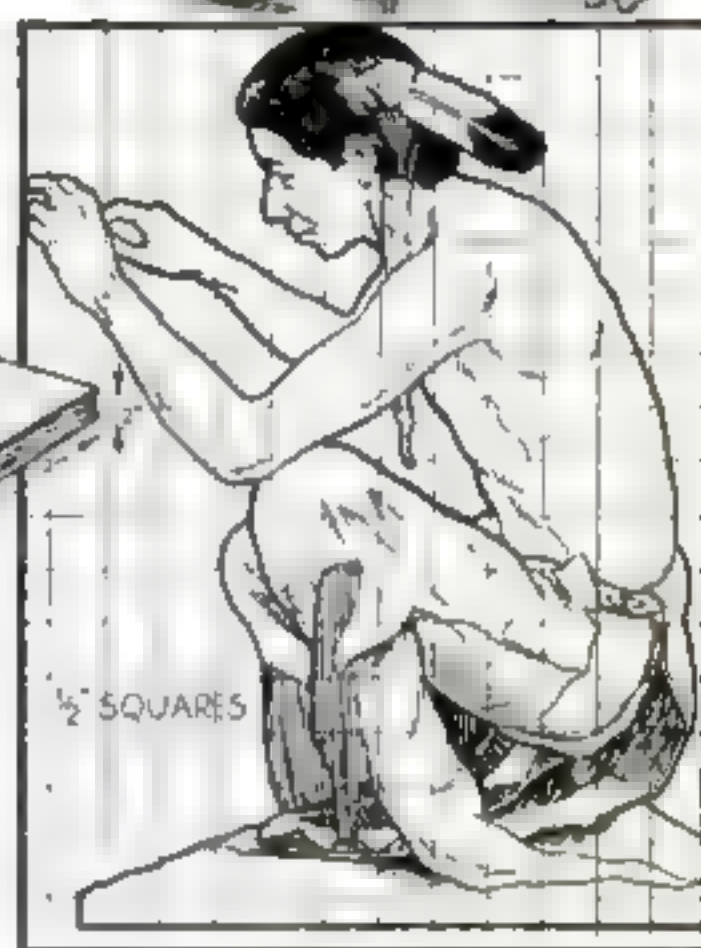
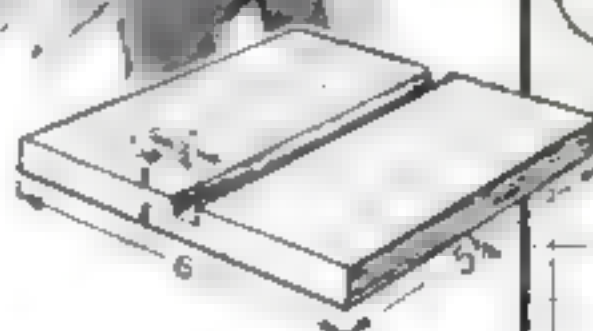


Picturesque Book Ends Represent Hopi Indians Weaving Rugs

The figures of the Indians are sawed from thin plywood



The rug design, which is painted on plywood; the white-pine base; and, right, pattern for Indians



AMONG the Hopi Indians, the men are often seen working rug looms. In this instance, the industrious young Hopi and his brother (for you must make two) act as keepers for some of your books.

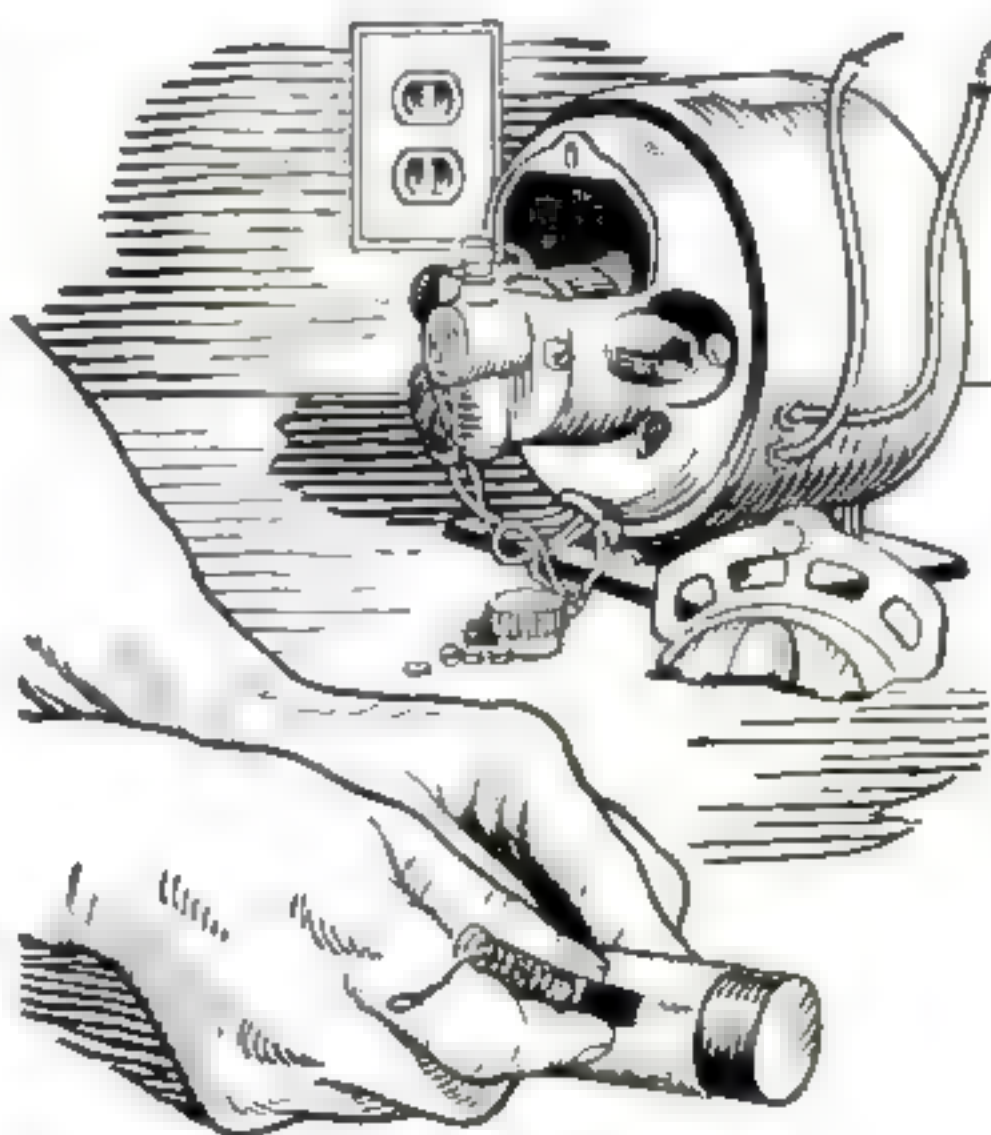
Use $\frac{1}{4}$ " three-ply veneer for the Indians and their rugs, and white pine $\frac{1}{2}$ " by $5\frac{3}{4}$ " by 6" for each of the bases. Draw the rug design and paint the white parts light gray, the shaded parts red, and the dark parts black. Before gluing the Indians in their grooved bases, paint them as follows: feather, white with black tip; hair, black with a bluish high light; braid wrapping, red; body, Indian brown (note

that part of Indian's body shows below the belt); loin cloth, red with yellow binding; leggings, tan; moccasins, white with top design in blue. Shade the face and body, and paint the ground a dark gray-green. Opaque water colors or oils may be used. Give the finished work a coat or two of clear varnish to protect the colors.—GRAY WOLF.

REPLACING BRUSHES IN ELECTRIC MOTORS

[ELECTRICAL]

IN BRUSH type motors, trouble with the brushes is usually indicated by excessive sparking, or the motor may not run at all. Remove brushes and clean out all grit and gummy oil from their guides. If brushes appear too short to make good contact, replace with new ones. Clean the commutator with fine sandpaper until bright and smooth. Wrap fine sandpaper on any available round object the same diameter as the commutator and carefully shape the ends of the brushes to fit the curve of the commutator and assure better contact.



POPULAR SCIENCE MONTHLY SHOP DATA FILE

TO IMPROVE YOUR PICTURES

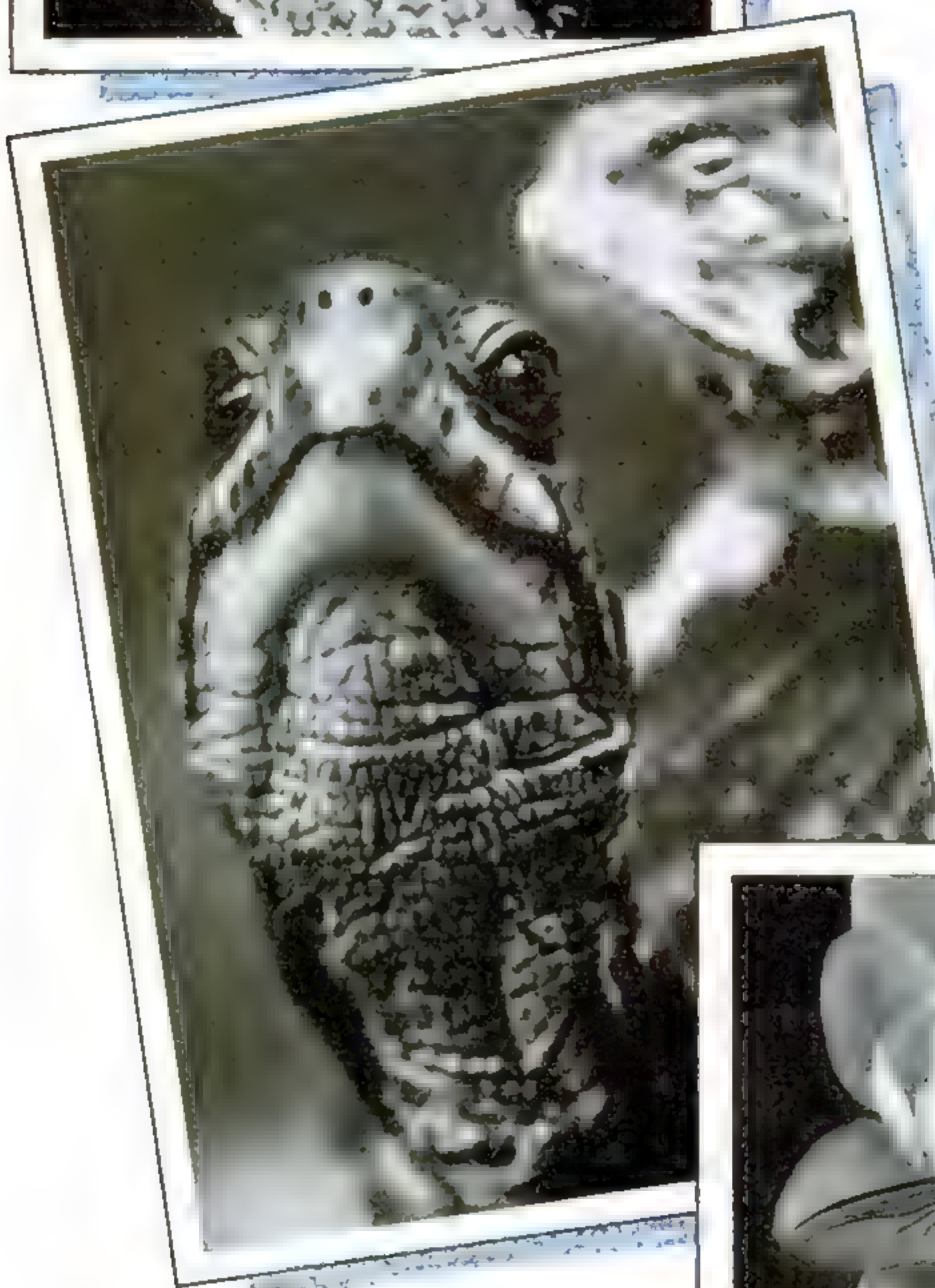
Take



IT IS a natural instinct for anyone, when looking at an object, to want to get a close view—a good clear look, we might say. Well, this applies very strongly to the art of taking photographs. Let the principal object in your picture stand out clearly and boldly. You will be surprised how much this will improve your work.

My specialty is nature work, where the subjects are often quite small and must stand out prominently to make an interesting picture. In taking a butterfly resting on a flower, for example, I make certain that butterfly and flower fill the view finder of my camera. This applies, however, to almost any subject, so don't be afraid to get close to what you are shooting. Show the public what that particular creature really looks like! If it should be an insect, such as my favorite sitters so often are, try a real close-up of its head. Very often this will reveal some grotesque feature that cannot be detected with the naked eye.

Regarding the background,



Top, cricket chirping. Bright sun; mirror to reflect light in shadows; 4" tube to extend lens; 1/25 sec. at F/5.6. Above, box turtle's head. Bright sun; 1/50 sec. at F/5.6. Right, dragon fly on water lily. Bright sun; 1/5 sec. at F/16. All superpan

Close-ups

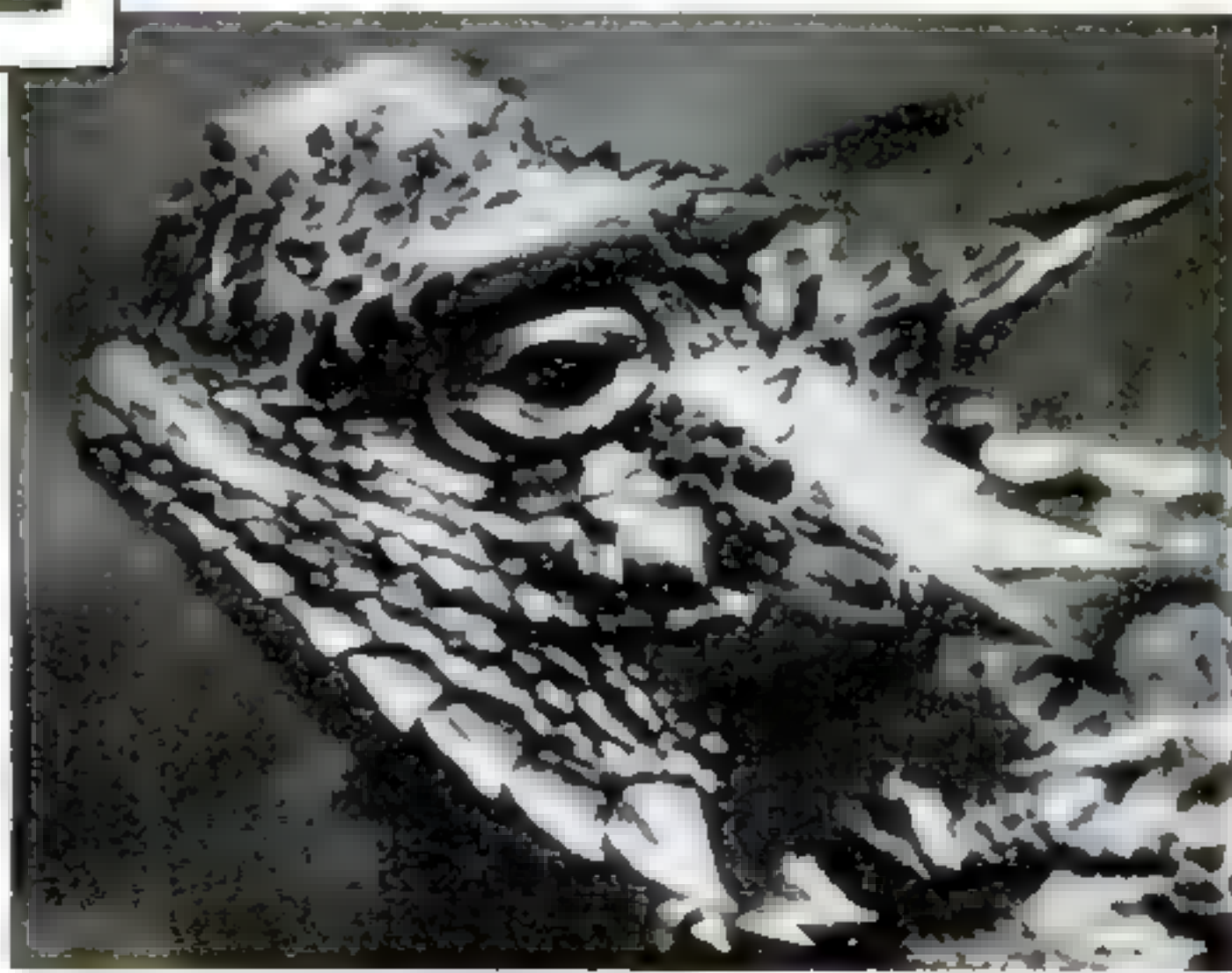
says **LYNWOOD M. CHACE**
famous nature photographer



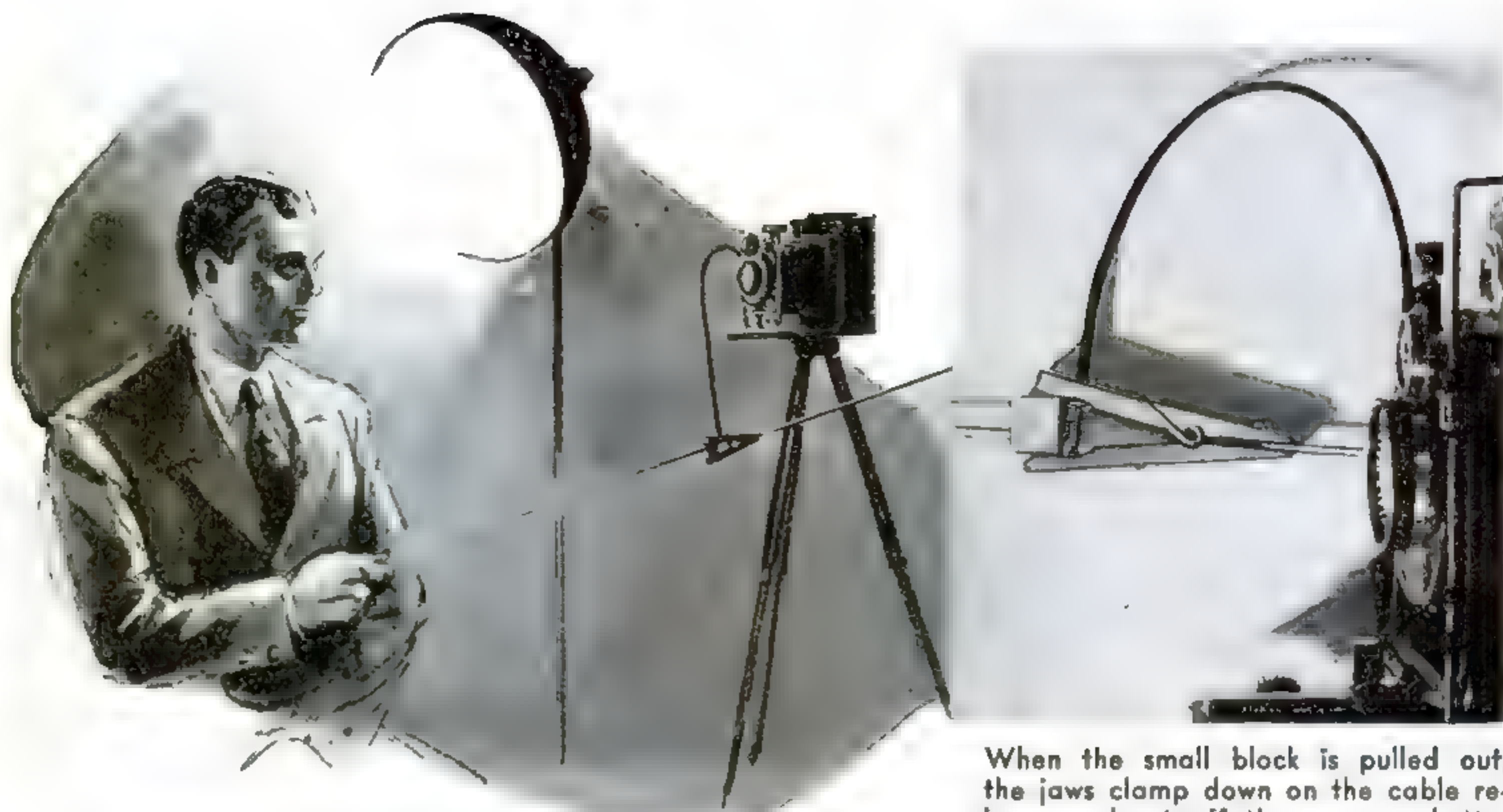
Girl and globe. Five No. 2 photo-floods 4' from subject; 1/5 sec. at F/3.5. Elk's new horns. Bright sun; 1/100 sec. at F/4.5. Both on superpan

the simpler it is, the better. The fewer objects in the background, the more prominently your subject will stand out. Of course, one can have some sort of artistic framing; there is no need to make just a stupid picture. A spray of flowers or a tree branch, for example, can add much to an insect picture.

For practice, begin with a subject not too small and find out what you can do in taking bold close-ups at various angles. When you have obtained satisfactory results, select a smaller subject. You will find it more difficult and may have to retake the picture several times, but film is comparatively cheap and each time you will get a fuller meaning of the value of close-ups.



Grotesque head of horned toad. Taken with 35-mm. reflex camera with 2" extension tube to get 6" from subject. In bright sun; 1/100 sec. at F/5.6. Extremely fast pan film



When the small block is pulled out, the jaws clamp down on the cable release and set off the camera shutter

Wooden Spring Clothespin Used as Self-Timer

AN EFFECTIVE self-timer, which will permit you to take a photograph and be in it too, can be made from a wooden spring clothespin. Take the clothespin apart and bore a hole as shown to pass the cord of the cable release, but small enough to stop the flange. In the other half make a shallow depression for the button of the cable release. Drill a hole in one of the handle ends, pass a string through it, and tie a knot.

Now slip the end of the cable release through the hole bored in it and assemble the clothespin so that when the jaws close, the button is pressed down. A block of wood large enough

to keep the jaws apart is then made and drilled to take a long black thread or string.

To operate, tie the string from the handle end of the clothespin to any solid object behind the camera. Attach the cable release to the camera, set the shutter, and, to make the exposure, pull the thread tied to the block that holds the jaws open. The jaws will then clamp down on the cable release and set off the shutter.

In one respect this is better than a standard self-timer because it enables the picture to be taken whenever the subject is ready, not at a fixed moment.—JOHN G. ROBERTS.

Speeding Up the Shutter of a Box Camera

IN ORDER to take photos of moving objects with an ordinary box camera, it is necessary to increase the speed of the shutter. This can be done by removing the front of the camera and sticking a piece of gummed paper over the slot in the shutter so as to cover half the opening, as shown. Then paint the paper black with India ink, or better still, use black cellulose tape in the first place. This will increase the speed of the camera from the normal 1/25 second to 1/50 second.

Use the largest lens opening, which is F/11, and consult an exposure guide to be sure the light conditions are suitable. With ordinary film, you can use the 1/50-second exposure at beaches and other open spots on bright days. Supersensitive film will enable you to take pictures when the light is not quite so good, and the new, ultra-speed film will aid even more. With the latter you can even cut the slot down so that only one fourth of it is open, giving a still higher speed of 1/100 second. This is about as fast as you can get with the method described and still obtain results that are at all satisfactory.—CARL FROEN.



For double speed, cover half the shutter slot with gummed paper

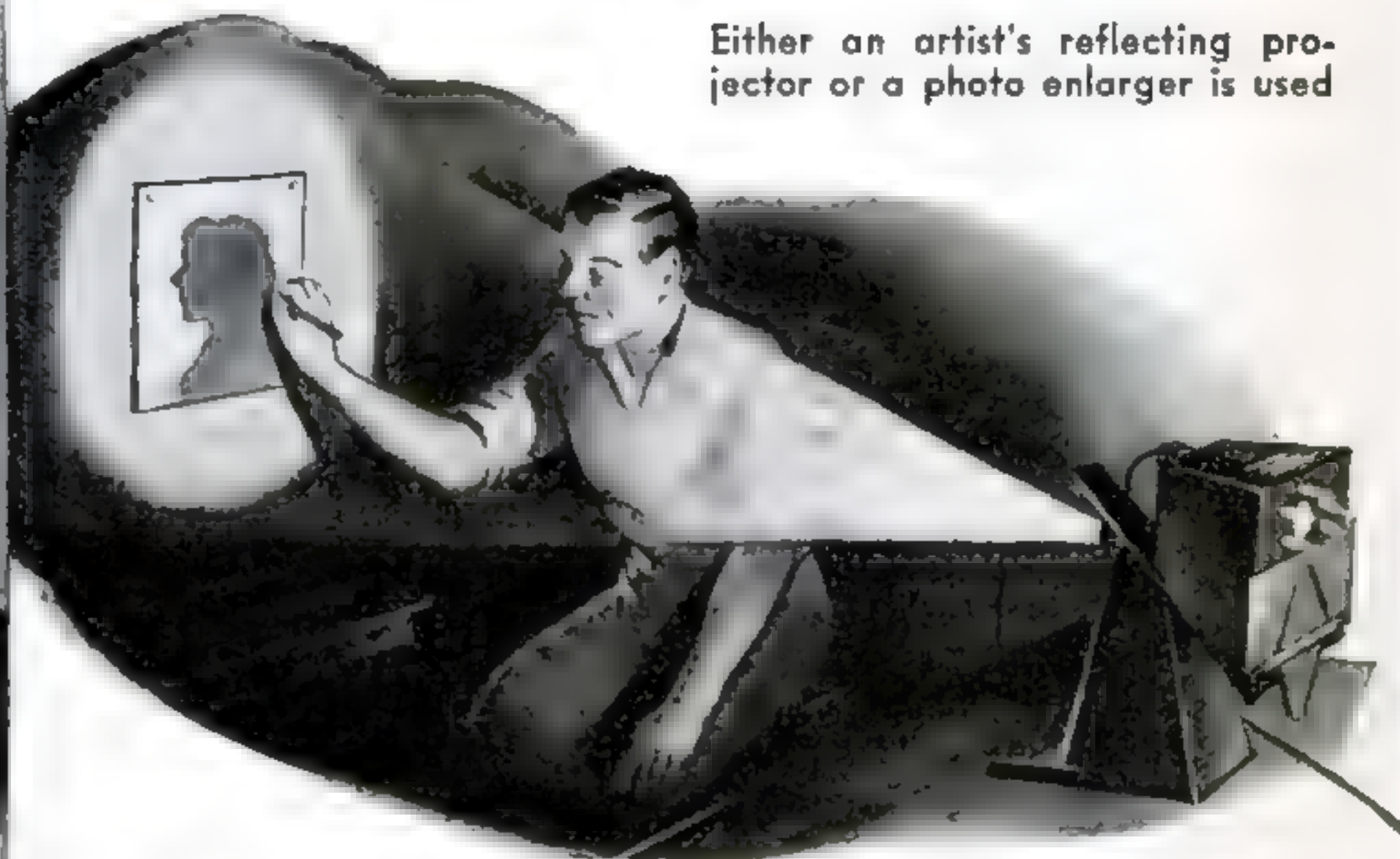
Photo Portrait Plaques

HAVE READY SALE

Either an artist's reflecting projector or a photo enlarger is used



The silhouette is cut from three-ply wood and mounted on a bread board



MAKING portrait silhouette plaques is not only an absorbing pastime, but also a pleasant way of earning extra money for anyone who owns a camera and a jig saw. To save time and insure accuracy, it pays to obtain a small reflecting projector-enlarger of the type used by artists. The one used by the writer cost only two dollars.

The silhouettes are cut from 3/16" three-ply basswood and are usually about 9 1/2" high. They are enameled black and mounted on 1/2" thick round or oval bread boards. These boards may be obtained in the 12" size for about twenty cents. The mounts are enameled white or ivory with the rim blue, green, or red. An equally attractive effect may be obtained by enameling the background black and the silhouette white or ivory.

Provided a portrait-adaptor lens is used to give a large, clear silhouette, the portrait may be taken on any bright, sunny day with any type of small camera. The subject sits approximately 2 1/2' inside an open doorway or window, while the camera is placed from 2 1/2' to 4' away. A snapshot is then made so the profile appears in sharp outline against the brightly lighted window or door opening.

If the picture has to be taken at night, stretch a sheet across a doorway between two rooms, seat the subject about 2' in front of the sheet, and set up a photoflood lamp with reflector on the opposite side of the sheet,

about 5' away. Then make a short time exposure on sensitive film. Printed instructions for making such silhouettes may be obtained from almost any photo supply dealer. If a reflector is not available, the photoflood bulb may be placed in the socket of the projector-enlarger and the back part of the device slipped off. It then serves as an excellent reflector.

When developed, the photographic print may either be enlarged in the projector-enlarger, or if none is available, by means of squares in the usual manner. Of course, if a regular photographic enlarger is at hand, the negative may be projected directly on the wood and the outline traced.

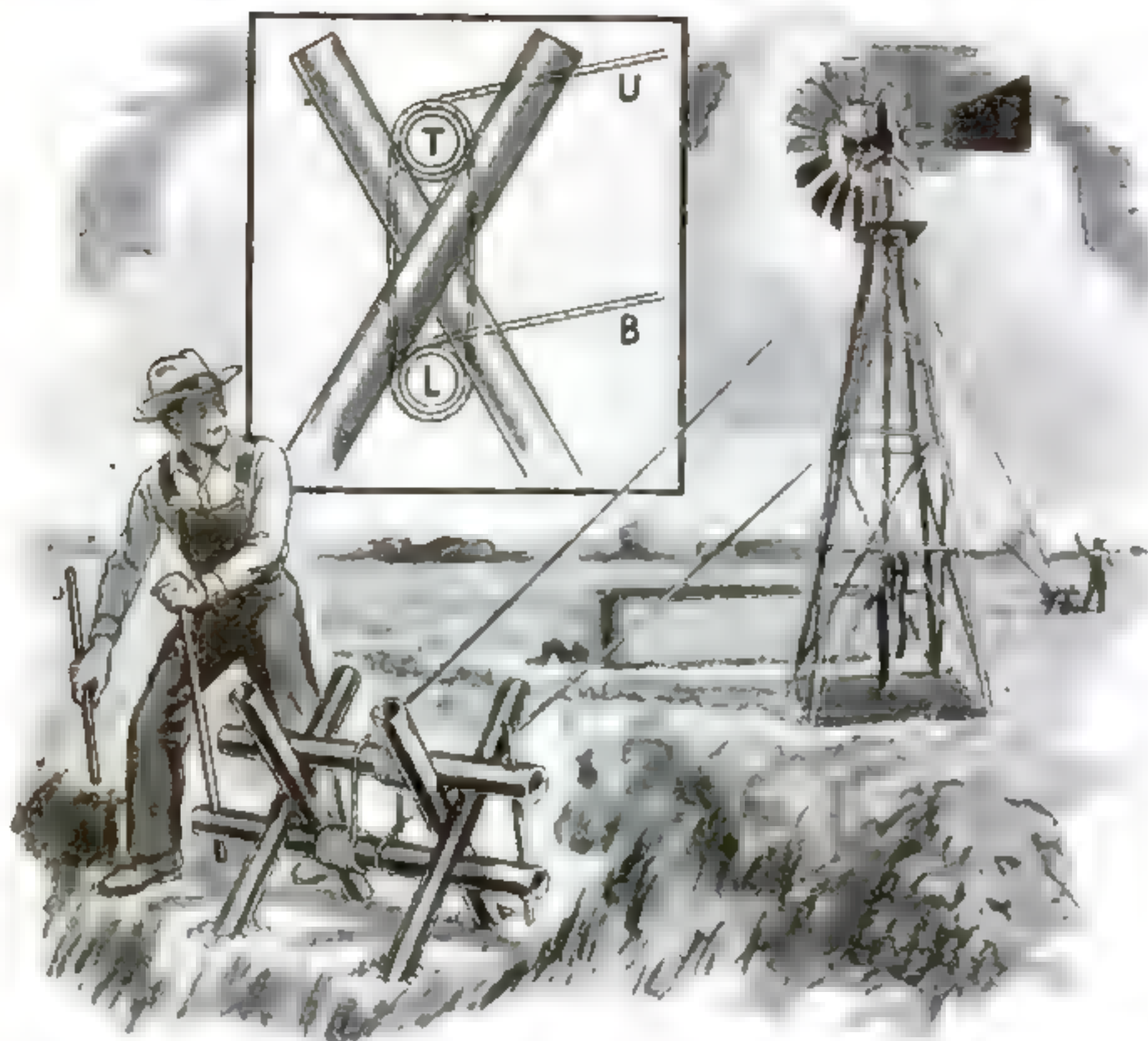
Few persons have more than a vague idea as to what their silhouettes look like, but the likeness obtained in this way is usually very good. It may be too good, indeed, for certain individuals who have some feature that seems exaggerated when seen from the side. Do not insist upon taking silhouettes of such persons because you may be wasting your time as well as the film.—LIONEL T. SCOTT.

Makeshift Pipe Wrench



IF YOUR pipe wrench is too small for a job, or if no wrench is available, just twist a loop of chain around the pipe as shown and use an iron bar or a piece of pipe for a handle.

Simple Adjustable Hitch Anchors Two Guy Wires



Two or more hitches may be needed for some types of work. In many cases a smaller size of pipe than illustrated may be used

○ DDS and ends of scrap pipe can be combined to make a sturdy adjustable hitch for derrick, windmill, or other guy wires. Two X-members are formed by driving pipe into the ground. In the V's formed above and below are placed two short pieces of pipe, in which holes have been drilled for the tightening bar.

The lower guy *B* is brought in over the lower pipe *L*, around it, and up to the upper drum *T*, where it is wound up until the guy has the desired tension. The drum pipe is then secured by driving the turning rod downward until it engages behind the end of the lower drum piece. The upper guy is led over the upper pipe *T* and down to drum piece *L*, which is then turned until the guy has been given the right tension.

The same construction can be used for a hitch for a single guy wire.—ELTON STERRETT.

Dowel Holes Bored Straight with Aid of Wooden Jig

IN ORDER to bore a number of dowel holes accurately by hand in hard maple, I constructed the jig illustrated, which resembles a miter box.

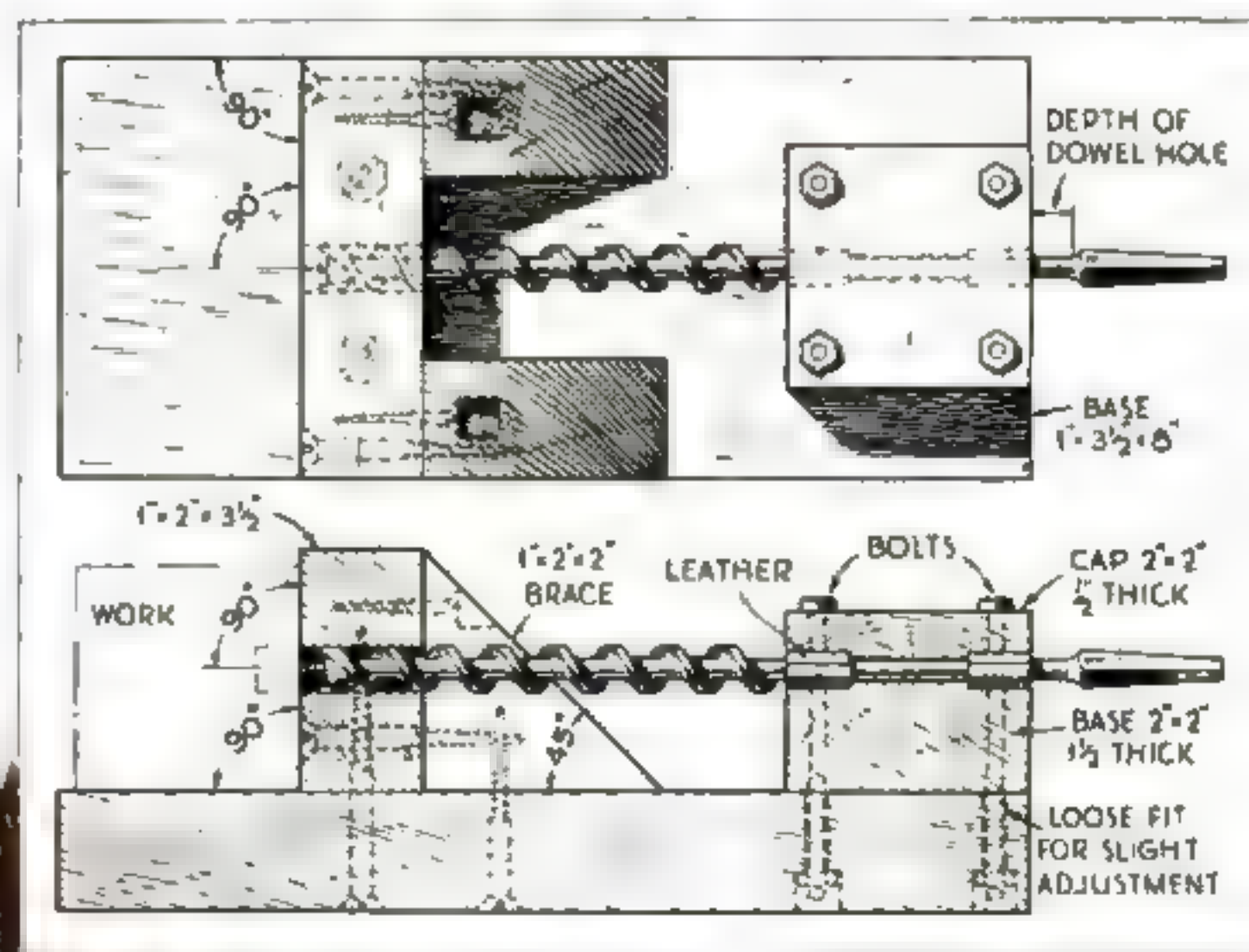
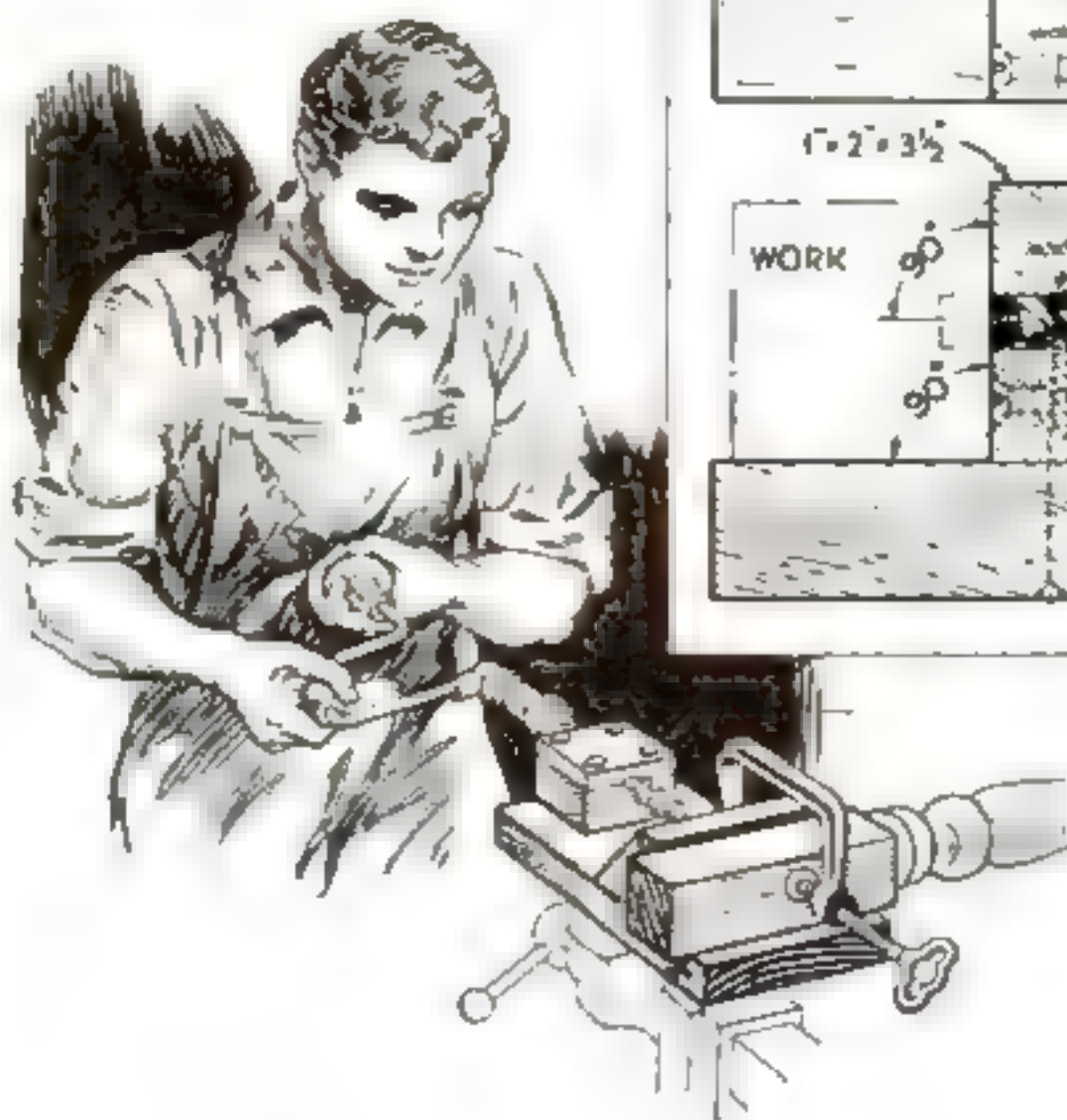
The guide for the bit shank consists of matching slots cut in the base and cap of the bearing. At the front and back more wood is gouged out so two pieces of leather can be wrapped around the shank and inserted as shown. When the cap is tightened on the oiled leather, the bit is held straight, yet can be turned easily with the brace.

Allowance is made for the travel of the bit so that when the jaw of the brace chuck comes up to the bearing block, the hole is just the right depth. Paper shims under the base of the bearing may be used to adjust the bit if it is not quite parallel, or the whole bearing may be twisted slightly if it is out in the other direction.

It is best to mark the wood to be bored with an awl at the point where the spur of the bit is to enter. By hold-

ing the work in the left hand a little away from the fence, the spur can be entered and set with one turn. The work is then set tight against the fence and pushed down against the base.

A cleat may be fastened to the bottom, if more convenient, and the whole jig clamped in a vise.—CHARLES M. GREEN.



If a cleat is added underneath, the jig may be set up in a vise. Ordinarily the work may be held by hand, but a C-clamp may be used if necessary as at the left

Post hooks allow the line to be taken off easily

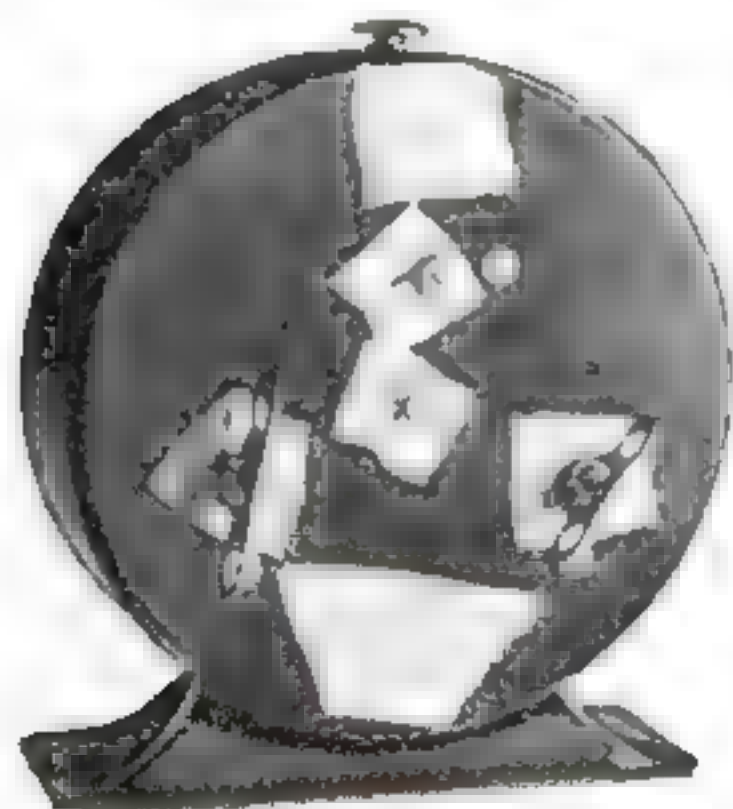


Removable Clothesline Lasts for Years

THE clothesline illustrated has been in continuous service for about seven years and still is in perfect condition. That is because it is not left out in the yard strung between the posts. Heavy hooks are used on the posts, and on washday the snap hook at the end of the line is fastened to the first post, the small pulley is placed on the hook of the second post, and the line tightener is attached to the third so the whole line can be pulled taut. If more posts are used, an additional pulley is strung on the clothesline for each one of the post hooks.—JAMES R. SCHLEGEL.

Tape Keeps Clock Dustproof

AN OLD clock or one of the cheaper variety without a modern dustproof case can be protected from dust, especially if used in a shop or other dusty place, by applying adhesive tape around the stems and over any openings.

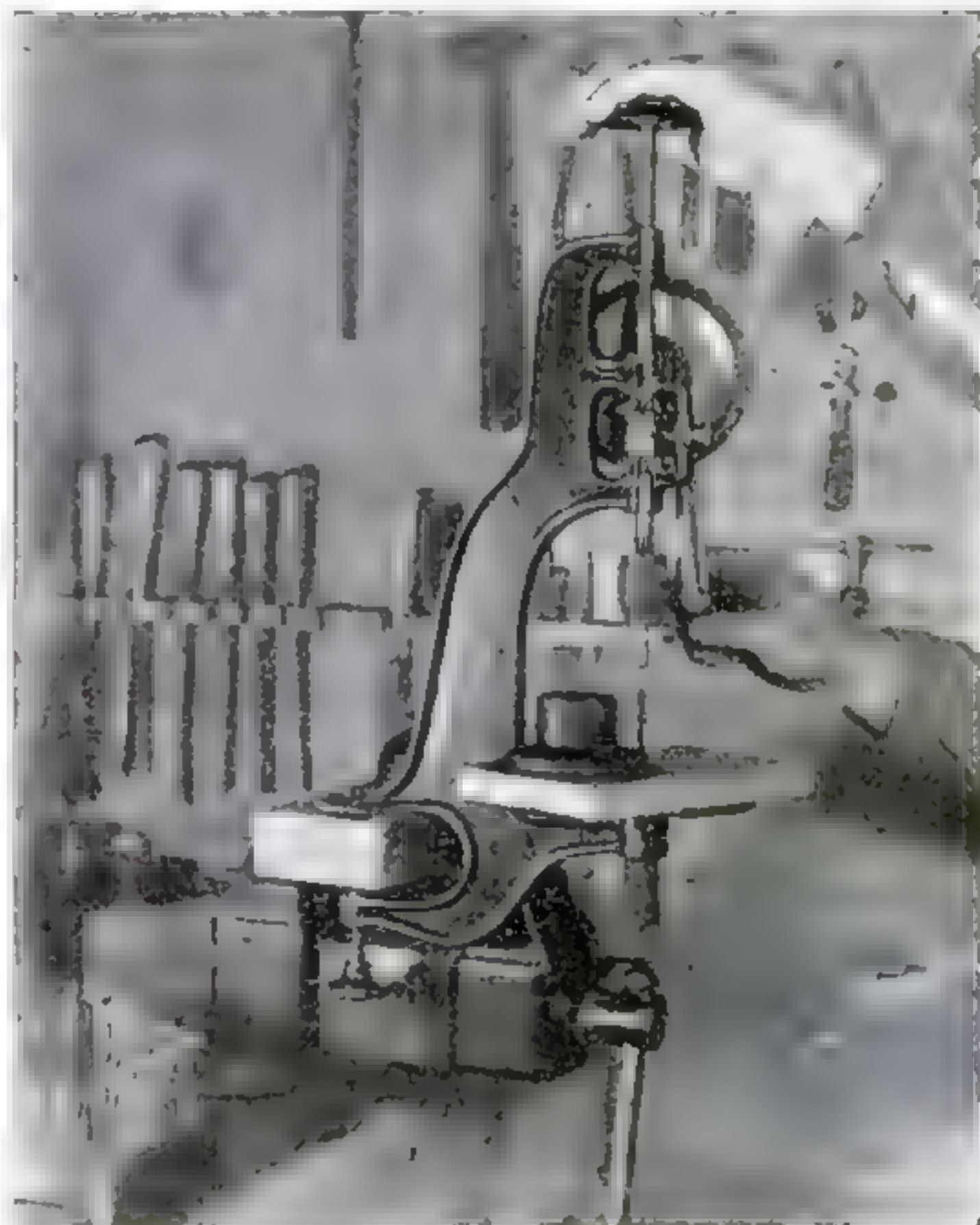


The tape over the regulator slot can be partly peeled off when it is necessary to regulate the clock, or pulled off entirely and a new piece of tape fastened in place afterward.

—CURTIS MORSE.

Hand Bench Drill Mounted in Vise to Save Space

ONE city dweller, who has to conserve space to the utmost in his small workshop, keeps his small hand bench drill clamped permanently to a short "two by four." To set it up for use, he takes it from its storage place and fastens the block in the vise as shown. A similar method is used for mounting the saw-filing vise and other fixtures in his workshop.—O.R.S.



Only a moment is needed to set up this hand drill

Tubing Guards Electric Cords

ELECTRIC-APPLIANCE cords can be protected and prevented from becoming kinked at the point of attachment by the use of rubber tubing. This is slipped over the cord where it enters the device—in the case illustrated, a soldering iron.—E.B.



The tubing prevents the cord from becoming kinked

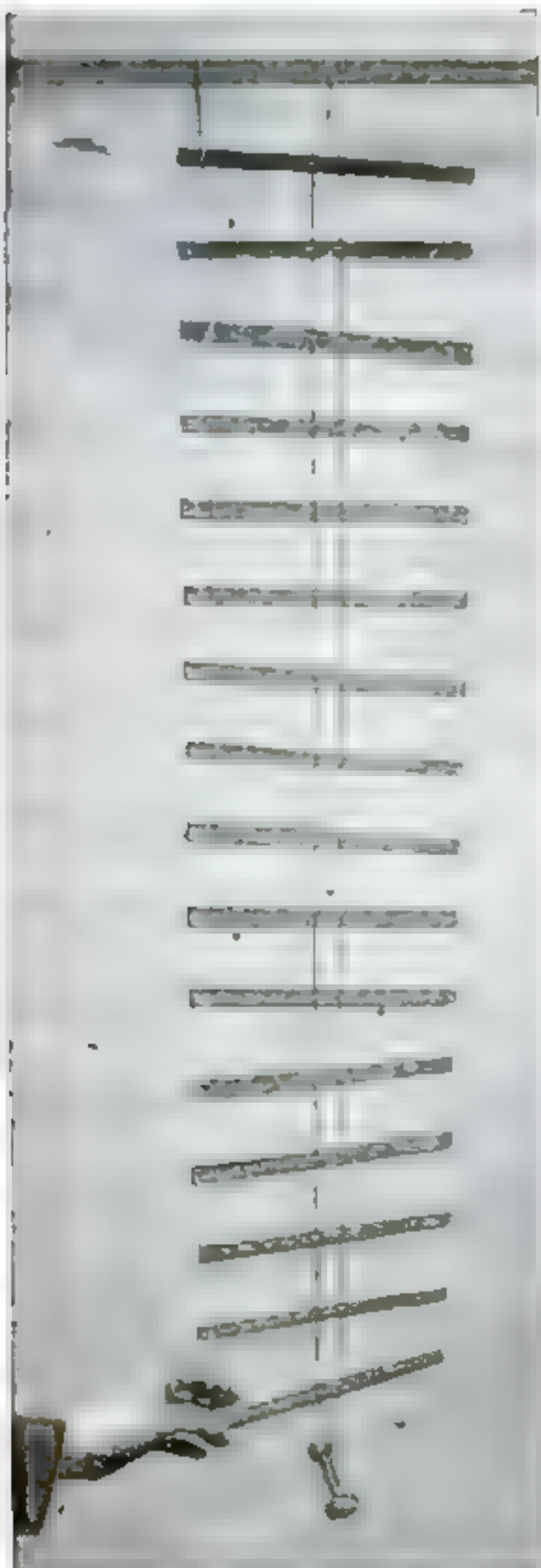
Science

You Can See Stars Twinkle in a Rotating Mirror

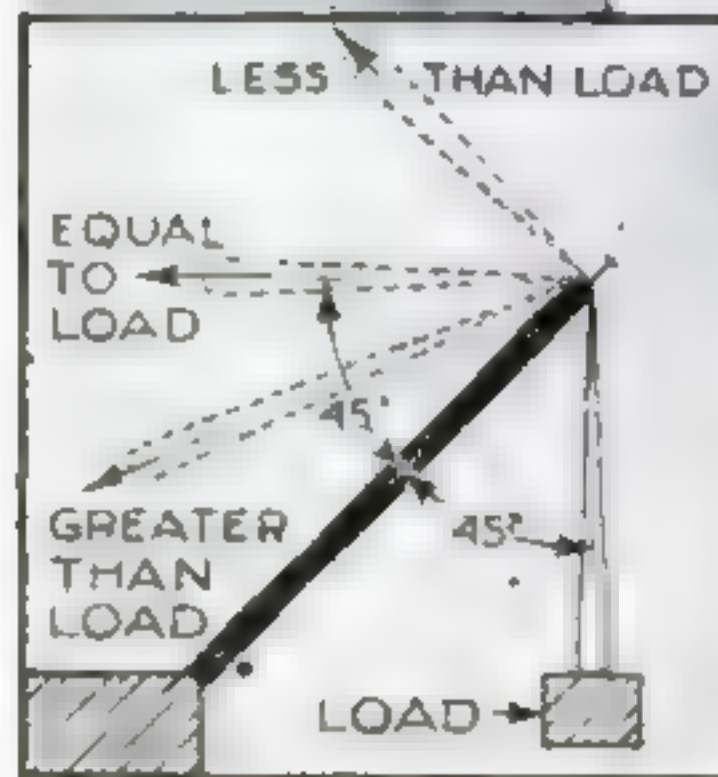
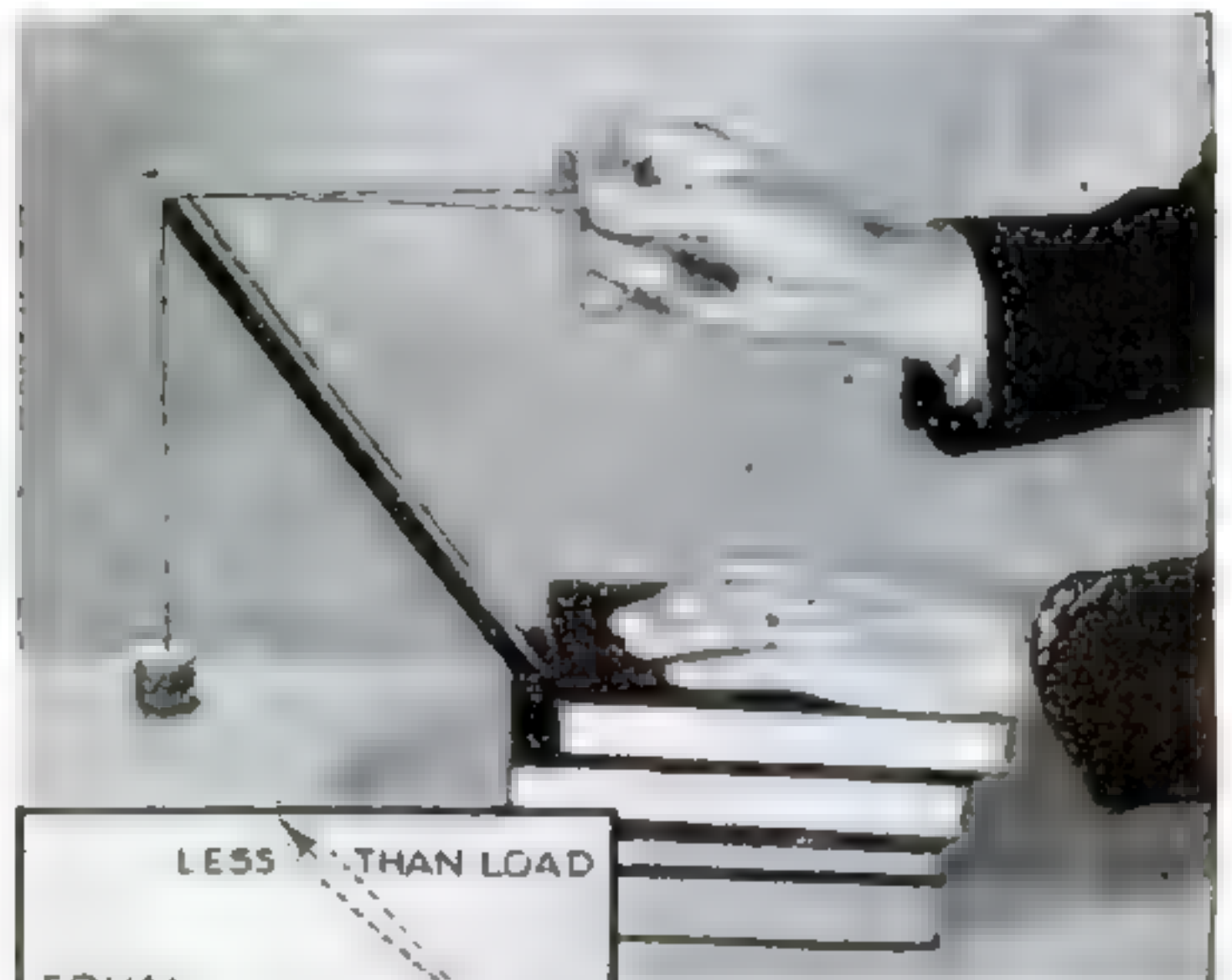
HERE is a novel way to watch the stars twinkle. Look at a bright star, preferably one that is low in the sky, in a hand mirror that you are twirling back and forth. You should see a broken streak of light, like a string of beads. Disturbances in the earth's atmosphere cause the interruptions, by refracting or bending the star's rays. If not completely interrupted, its light may change in color—since some colors are refracted more than others—and you will see a varicolored streak in the mirror. The rotating-mirror trick will also show the separate flashes of a neon sign or movie.



Simple Model Illustrates Laws of Wave Movement



FASTEN two parallel strings to sticks of wood, with staples about an inch apart. Suspend the column from a single string and hang a weight at the bottom. To send a wave up the column, give the lowest stick a quarter twist. Increase the weight, and the wave travels faster. Each wave is reflected at the top, and the type of reflection may be modified by leaving the top stick free or tethering it with a cord as shown, offering an analogy to the action of open and closed organ pipes. Continuous waves may be sent and timed so that they meet and form stationary or standing waves.



With the boom at an angle of forty-five degrees, the pull on a horizontal supporting band is the same as that on the band suspending the load

Rubber Bands Show Forces Acting on a Crane

A LIGHT stick and a pair of matched rubber bands will demonstrate forces that act on a crane. For simplicity, disregard the weight of the boom. Equal stretching of the rubber bands, when the boom is at the forty-five-degree angle shown, indicates that the downward pull of the load would produce an equal pull on horizontal cables supporting the boom. At other angles, the supporting band is longer or shorter.

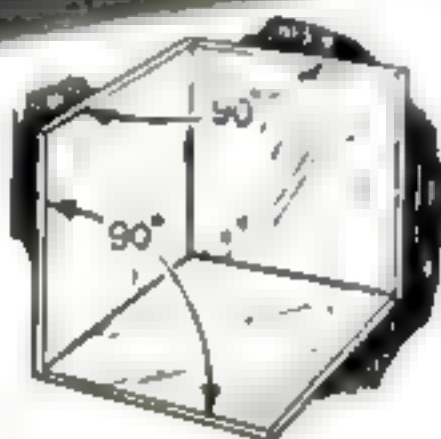
in Easy Tests

MYSTERIES OF NATURE
EXPLAINED BY STUNTS
ANYONE CAN PERFORM



Three Mirrors Explain Reflector Signs

HOLD three mirrors together at ninety-degree angles, like the inside of the corner of a box. Whatever the direction from which you look into the mirrors, you will see your reflection. Applying the same principle, many highway warning signs employ metal reflectors in which indentations with ninety-degree corners are stamped. Then, from any angle, light is reflected in a driver's eyes.

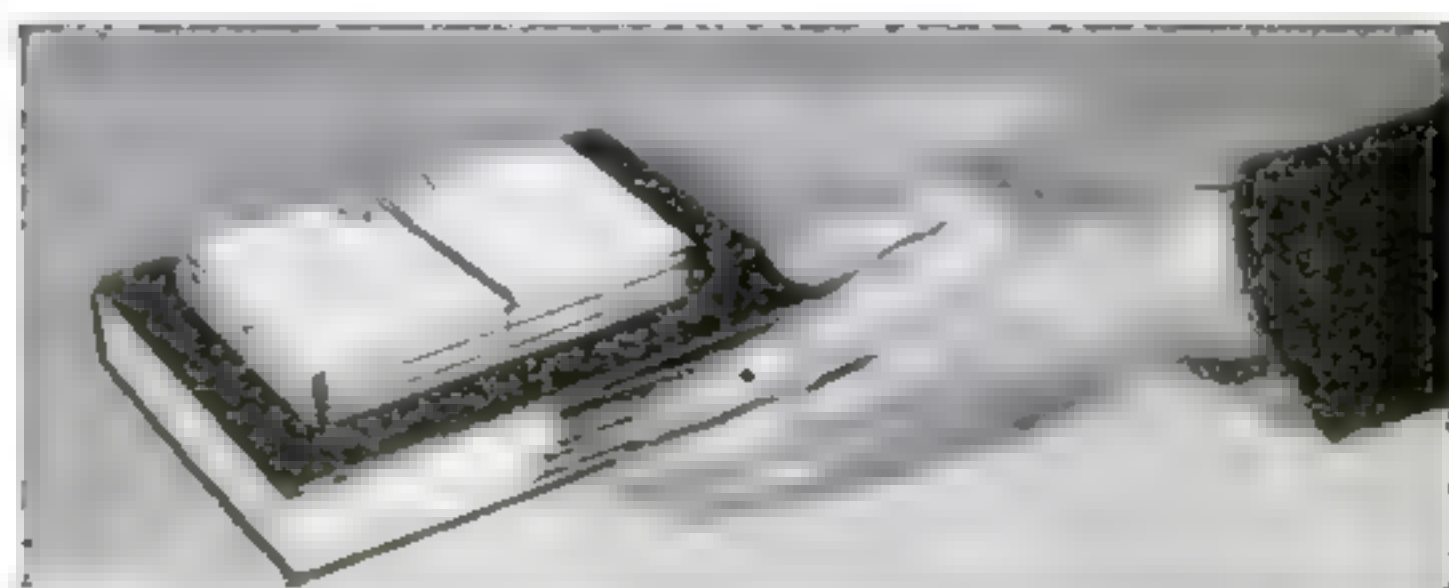


Polarized Light Reveals Stresses in Celluloid

WHEN the ends of a U-shaped piece of celluloid are pressed together, actual strains in the material may be seen with the arrangement shown above. Light from the blue sky, ninety degrees away from the sun, falls at the indicated angle on a piece of window glass with the back painted black. Held loosely as shown, the celluloid piece will appear dark as viewed in the reflector, but the strained parts will appear lighter when the celluloid is distorted. Similar effects can be observed by twisting pieces of celluloid with pliers or a clamp. Engineers use this "polarized light" method to study strains in mechanical and structural models made of celluloid.

Homemade Instrument Detects Heat Rays from Hand

HEAT rays from your hand can be detected several inches away by a simple homemade instrument. Stretch one or two rubber bands around a block of wood. At the center of one side, insert a pin, bearing a paper pointer, beneath the bands. Now hold your hand two or three inches from the block, as shown, and the pointer will move. The heat makes the stretched rubber expand and the pin roll, rotating the pointer across the scale. Only half of the front of the block should be exposed to the heat rays, as otherwise the rubber would expand equally on both sides of the pin and it would remain stationary.



Heat of the hand expands rubber bands on one side of the pin, causing it to turn and thus move the pointer



Timely Hints



A slanting panel on this receiver allows it to be tipped either up or down for convenience in tuning

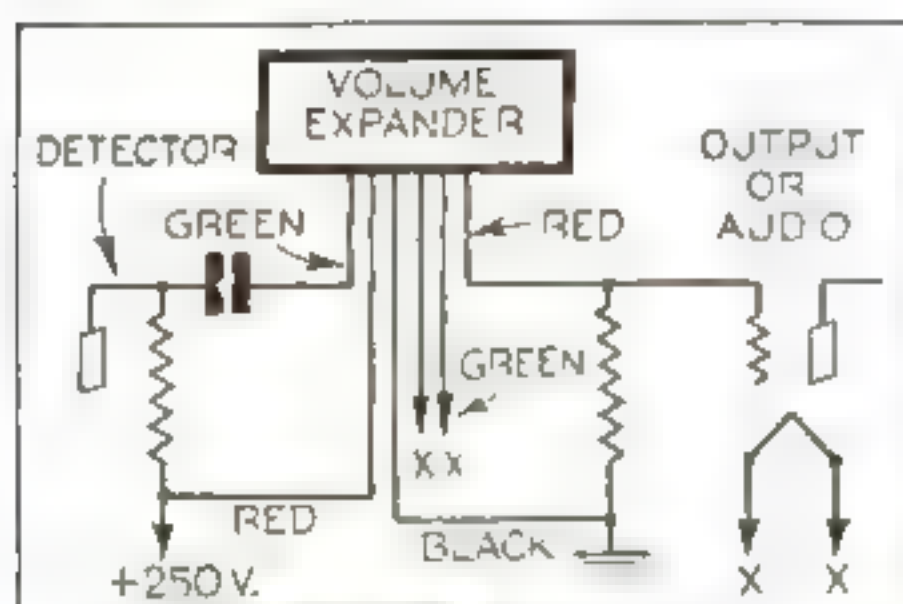


Tip-Up Receiver Is Easily Tuned

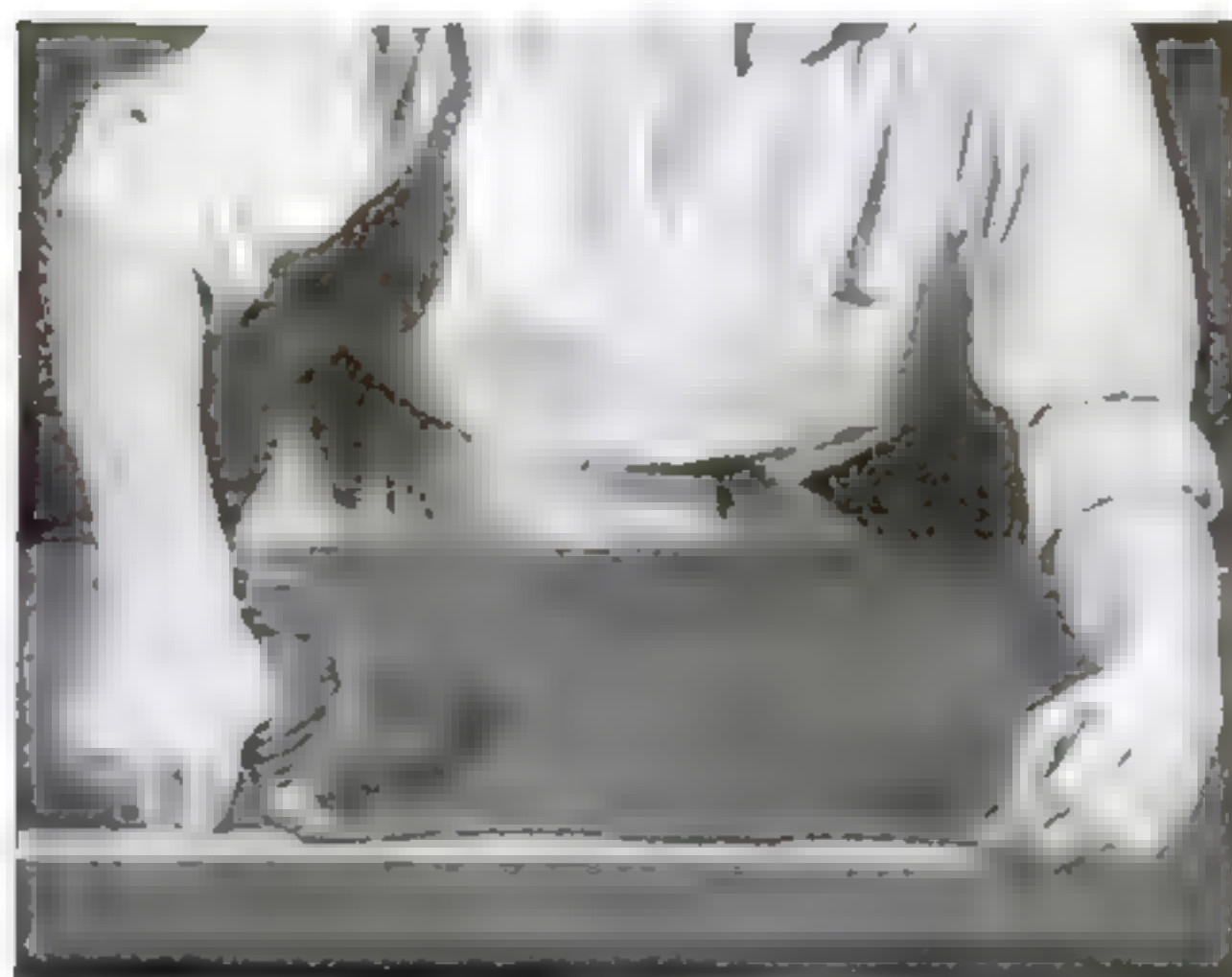
DESIGNED so that it may be placed on a table in either of two positions, a novel radio receiver has push-button tuning that is always convenient to see and operate. When the radio rests on one side, the controls are handy to those seated near-by. Tipped up, it is easily tuned by a person standing.

New Radio Volume Expander

EASILY attached to any radio receiver, a compact volume expander is said to increase the realism of symphonic or classical music, especially if the selection is a phonograph recording. The two-tube unit is built on a steel chassis enameled in gray, and can be connected to almost any circuit in a few minutes.



Wiring diagram shows how the volume expander is connected to radio hook-up. Right, the compact, two-tube accessory



Line-Cord Resistance Can Be Cut To Order

ANY desired line-cord resistance value can be supplied with a line cord now available in long lengths. Each foot of the wire has a standard resistance of twenty ohms. If a 160-ohm line is called for in a radio circuit, the amateur simply cuts off eight feet, wiring one end into the set and attaching a plug to the other. The handy resistance cord is pictured above.

for Radio Amateurs

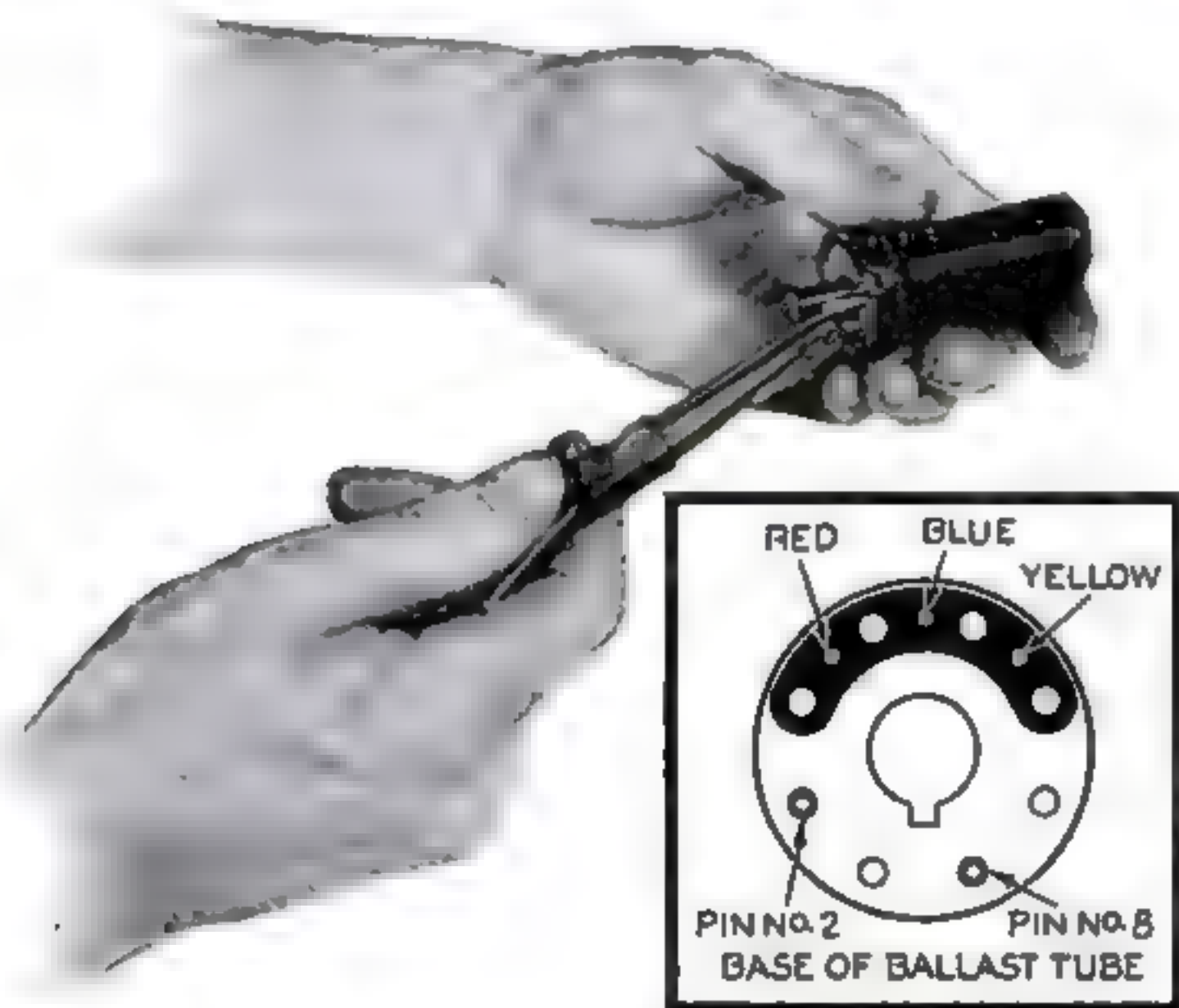
Ballast Tubes Adaptable To Various Circuits

Two special ballast tubes designed to replace most of the octal-base types will aid the radio experimenter. Removable pins act as taps on the winding for the pilot-lamp shunt, while a special shunt strip on the base connects to resistors giving voltage drops of six, twelve, and twenty-four.



Pocket Device Identifies Pins on Radio Tubes

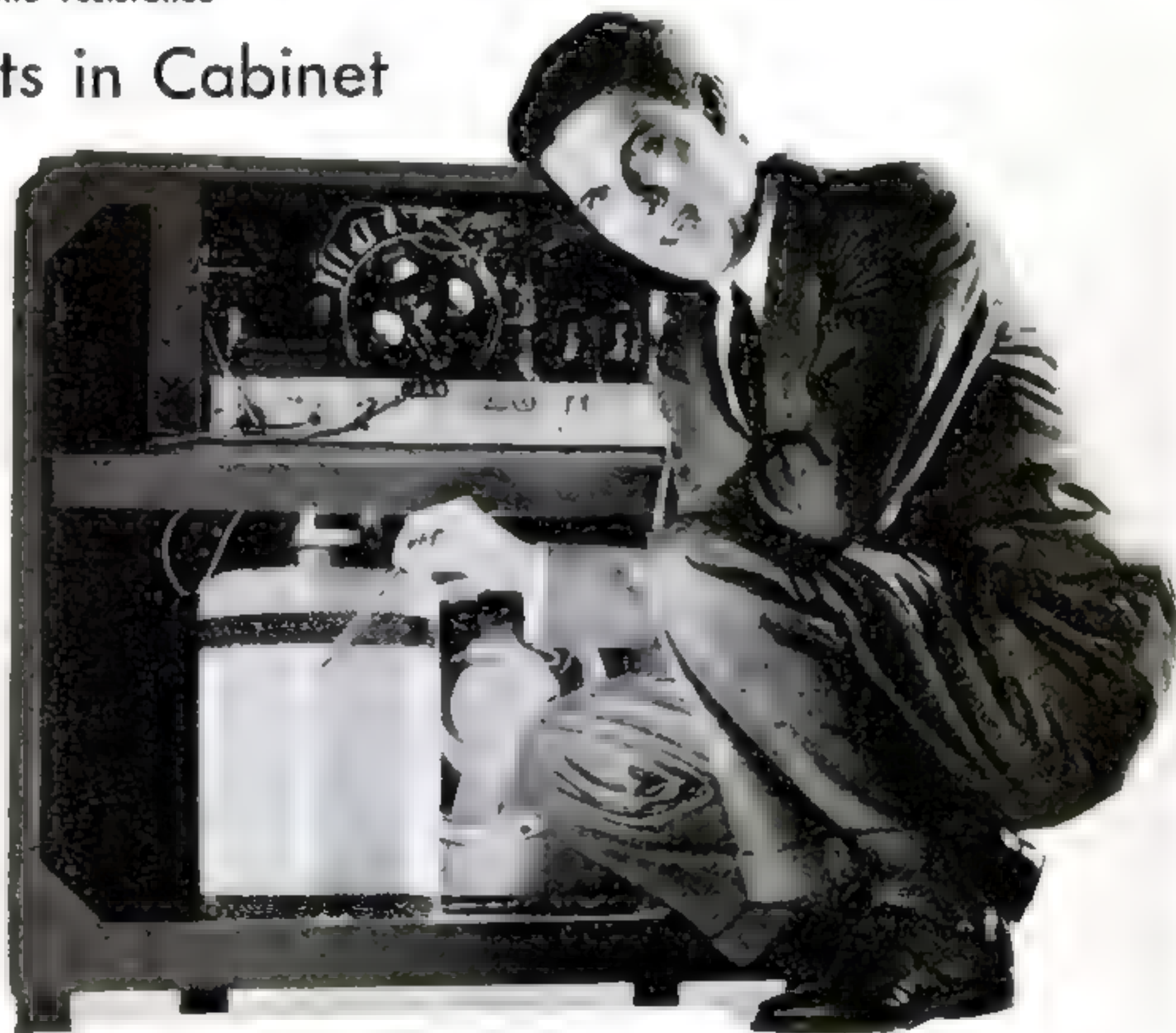
SETTING the slide in a new "automatic" tube chart to correspond with the "type number" of a tube immediately indicates the proper socket connections for the tube. All common tube types are shown by the indicator, which is of convenient pocket size. In the illustration above, a metal tube with six prongs is being compared with the indicator on which its prong positions are shown graphically, each pin appearing in a transparent window beside a pictorial representation of its socket.



Above, removing a pin from a ballast tube. Cutting the metal strip, shown black, alters the resistance

Shielded Antenna Fits in Cabinet

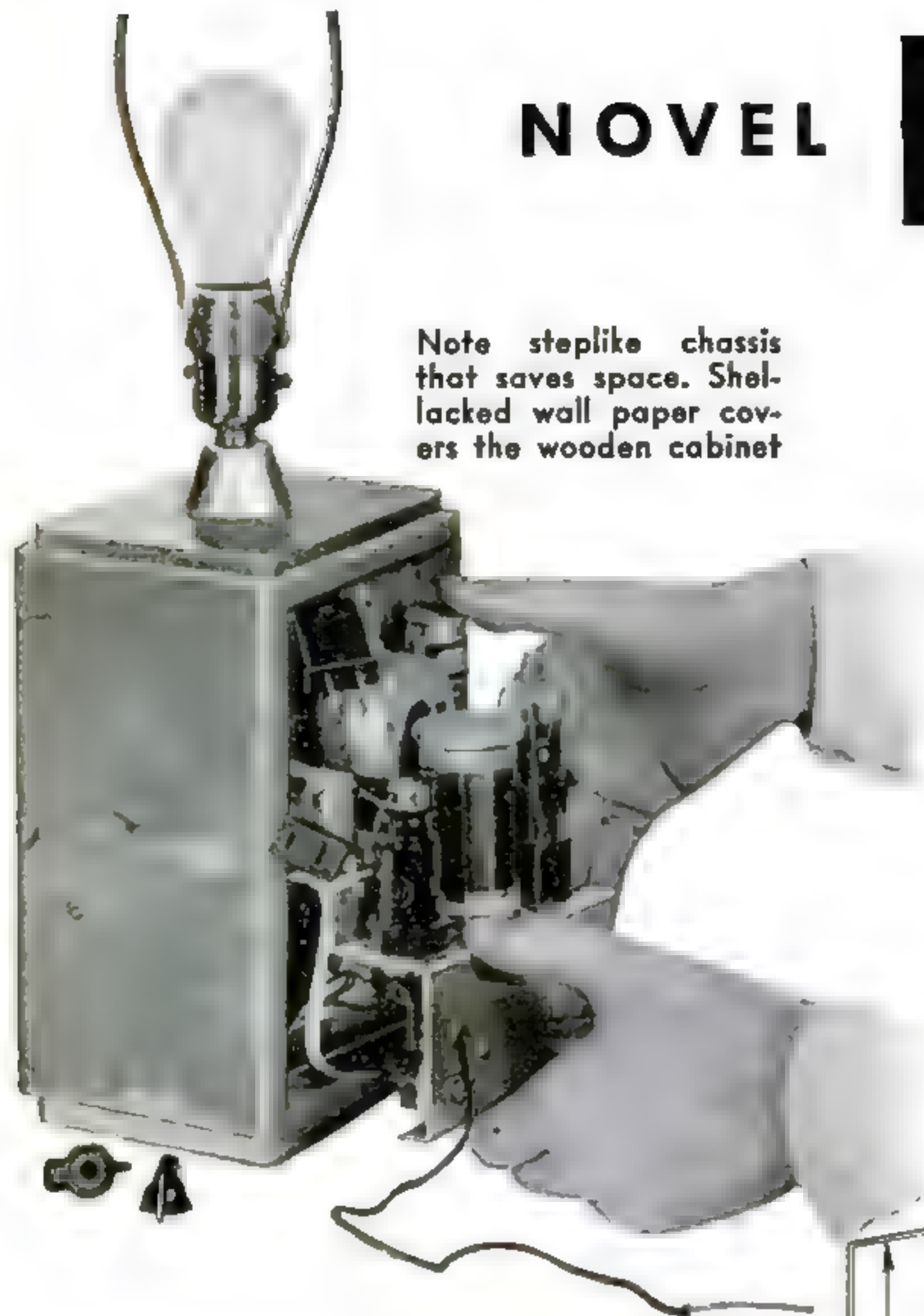
FOR improving reception of local, high-fidelity radio programs, a new self-contained antenna has just been devised that is said to eliminate interference from man-made static. The device is housed inside the radio cabinet, as shown at the right, and is similar in operation to a loop antenna. A special shield incloses the unit. When the radio is installed for a purchaser, the special built-in antenna is rotated to a position where it operates most efficiently. A convenient switch allows the special antenna to be cut out of the circuit when a conventional antenna is desired for tuning in radio programs that originate from distant stations.



NOVEL Lamp Radio

IS EASY TO BUILD

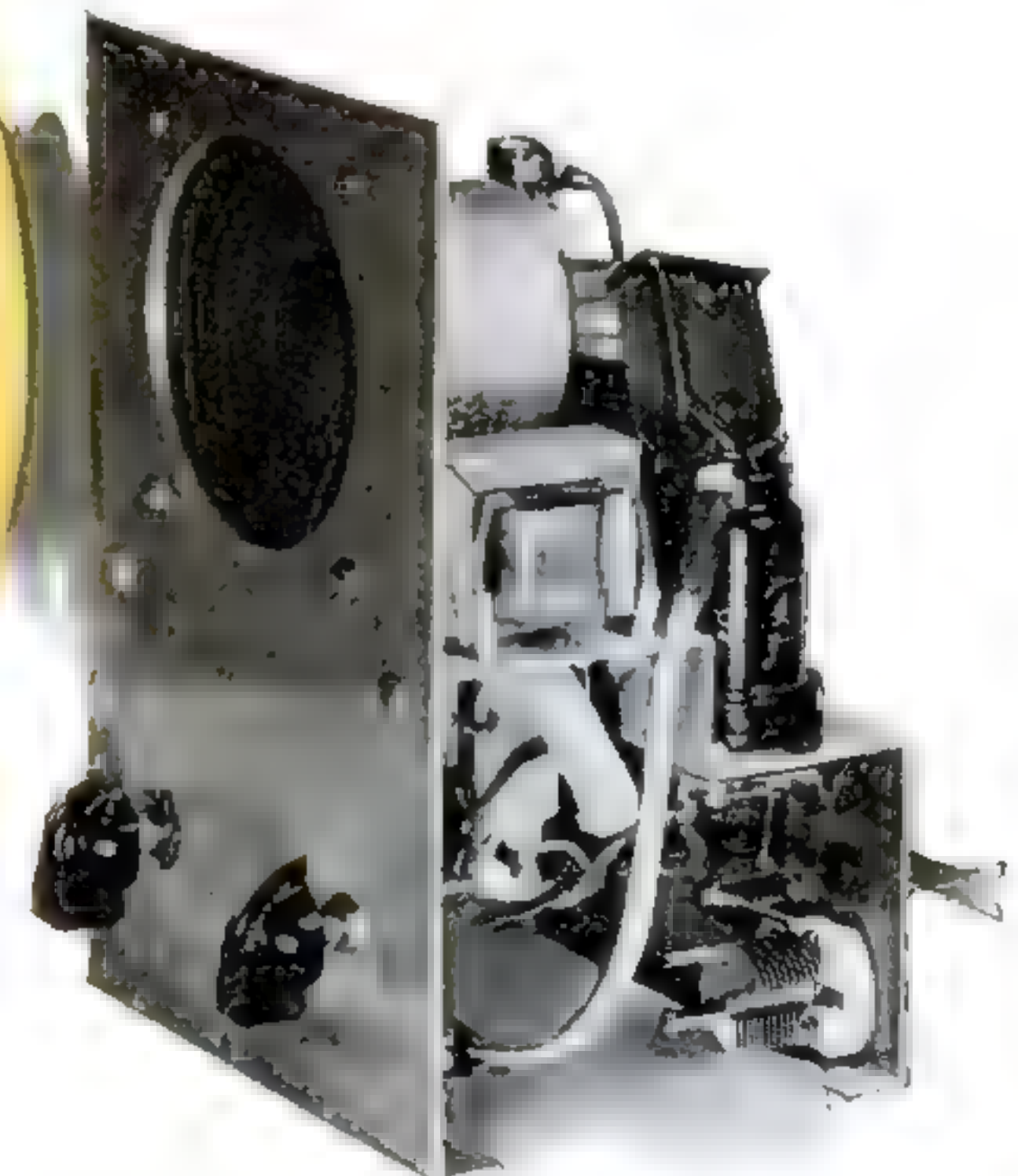
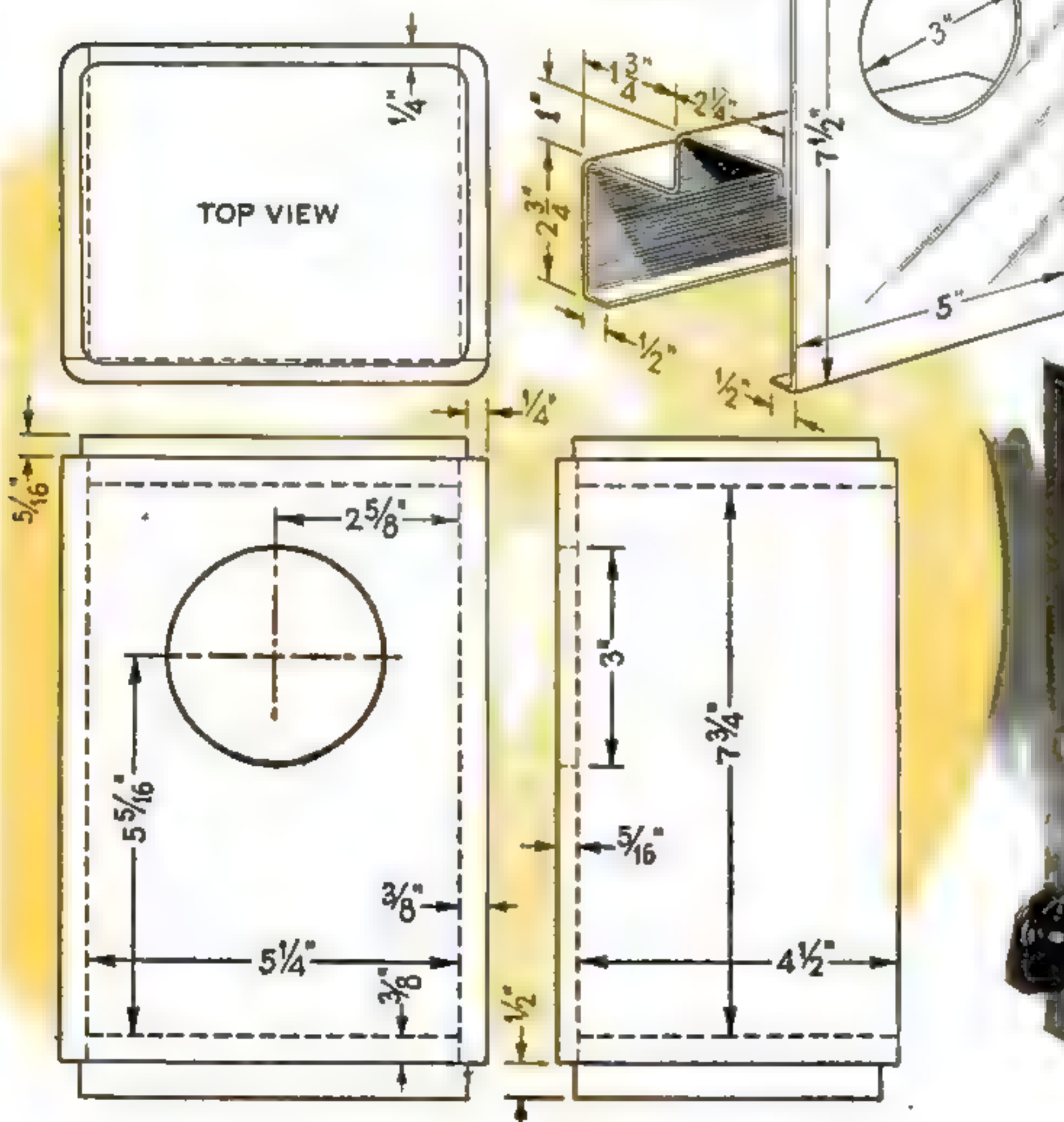
Note steplike chassis that saves space. Shellacked wall paper covers the wooden cabinet



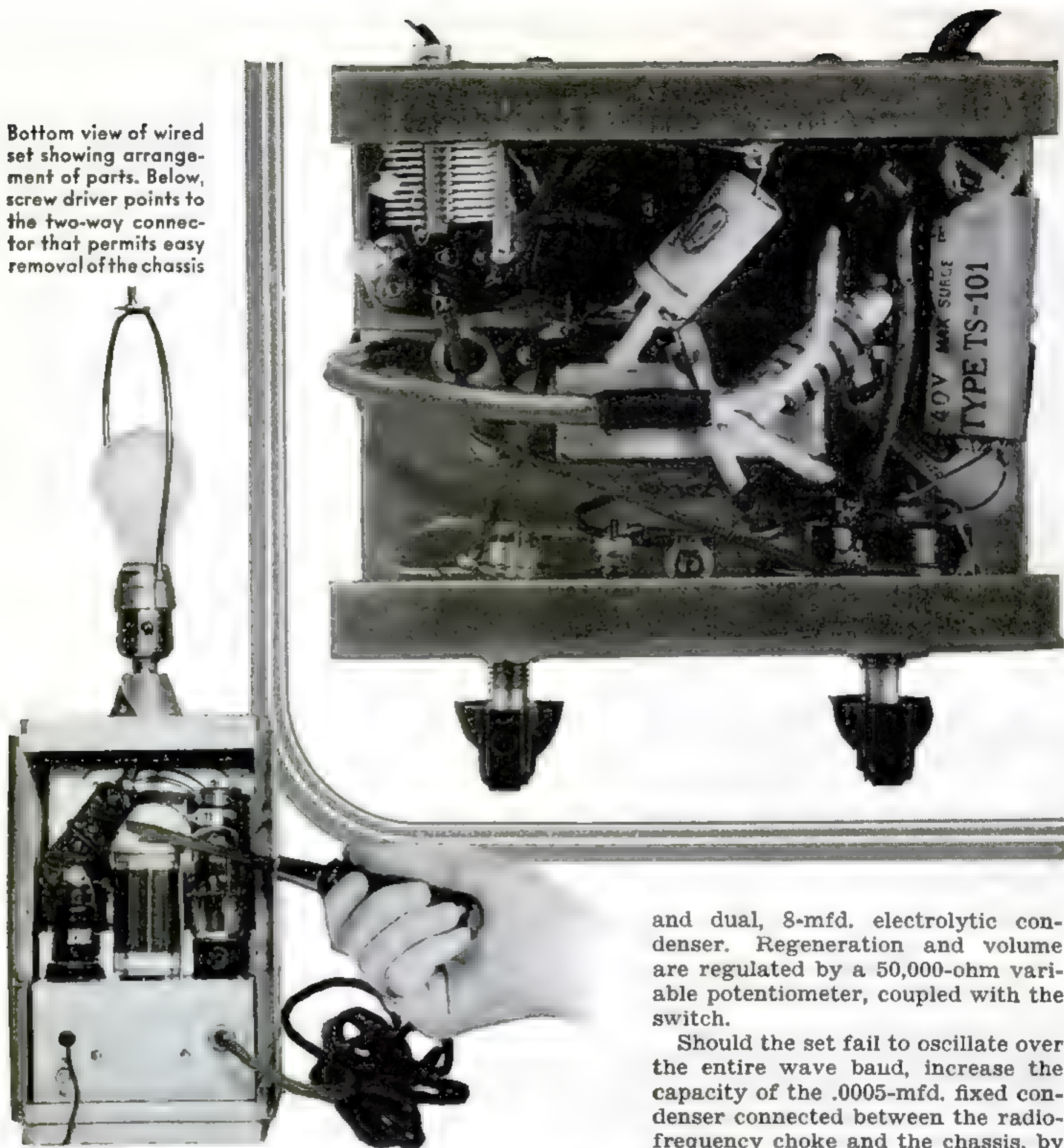
COMBINING a reading light and a broadcast receiver, this Chinese lamp radio will form a useful as well as an attractive addition to a living room, a bedroom, or a den. It is easy to assemble, and the use of a modern dual-purpose tube makes the necessary parts few in number and inexpensive.

You don't even have to be an artist to apply its artistic finish. Select any attractive wall paper of Chinese pattern and simply glue it to the wood cabinet. When the glue dries, apply a coat of thin, colorless shellac. The light fixture can be bought at a hardware store, and a lamp shade to blend with the wall paper can be almost as inexpensive as you wish.

The parts for the compact, two-tube radio cir-



Bottom view of wired set showing arrangement of parts. Below, screw driver points to the two-way connector that permits easy removal of the chassis



LIST OF PARTS

- | | |
|--|--|
| Line-cord resistor, 310 ohm. | Tubular condensers, .02 (two), and .01 mfd. |
| Midget choke, 15 h. | Plate choke, 2.5 mh. |
| Plug-in coil, 4-prong (See text). | Resistors, 2 meg., $\frac{1}{2}$ watt, and 100,000 ohm, $\frac{1}{2}$ watt. |
| Padding condenser, .000075 mfd. | Resistor, 200,000 ohm, $\frac{1}{2}$ watt. |
| Tuning condenser, .0005 mfd. | Resistor, 750,000 ohm, $\frac{1}{2}$ watt. |
| Dual electrolytic condenser, 8 and 8 mfd. | Wire-wound resistor, 2,000 ohm, 1 watt. |
| Dry electrolytic condenser, 10 mfd., 25 v. | <i>Miscellaneous.</i> —Chassis, midget sockets, output transformer, indoor antenna, speaker, tubes, etc. |
| Volume control and switch, 50,000 ohm. | |
| Mica condensers, .0005, .0003, and .00015 mfd. | |

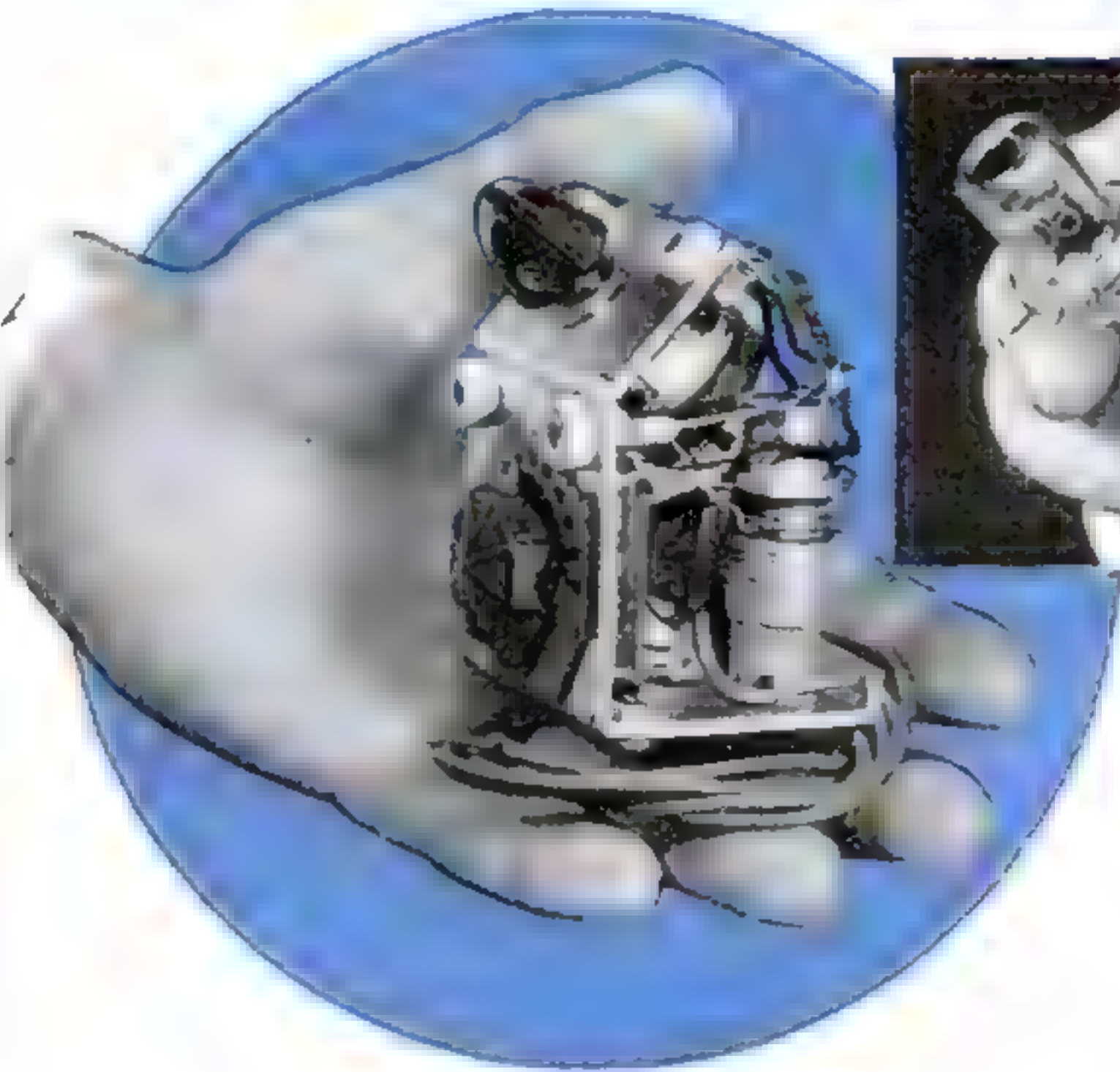
and dual, 8-mfd. electrolytic condenser. Regeneration and volume are regulated by a 50,000-ohm variable potentiometer, coupled with the switch.

Should the set fail to oscillate over the entire wave band, increase the capacity of the .0005-mfd. fixed condenser connected between the radio-frequency choke and the chassis, by wiring another fixed condenser of .00025-mfd. capacity in parallel. The original model worked well without a ground, but if you wish to try one, connect it through a .02-mfd. condenser as shown by the dotted lines in the circuit diagram. The condenser must be used to insulate the ground from the chassis and protect the tubes, which are also grounded through the chassis to the electric-wiring system.

A two-way plug, placed just above the metal pentode as shown in the photographs, connects the wires from the lamp socket with the current-supply cord leading to the radio, making it easy to disconnect the wiring for removal of the chassis from the set.

Midget Broadcast Set

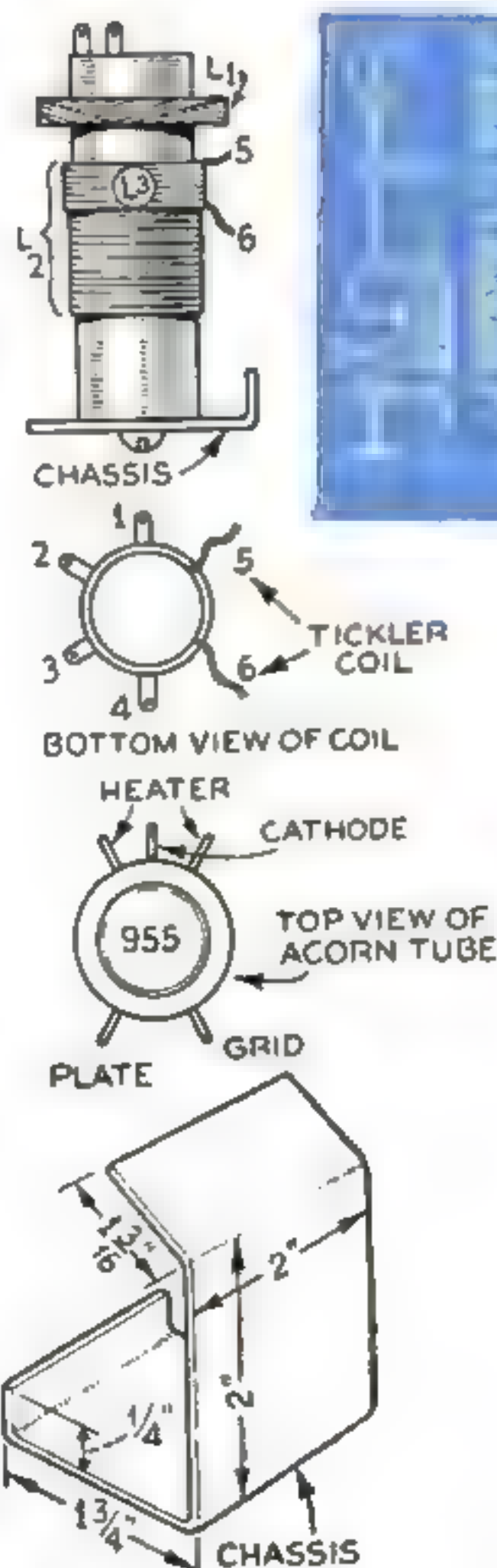
USES TINY ACORN TUBE



By ARTHUR MILLER

SO SMALL it fits in the palm of your hand, this little radio receiver makes use of one of the midget, acorn-type tubes. Powered by batteries, it provides good earphone reception on the broadcast band.

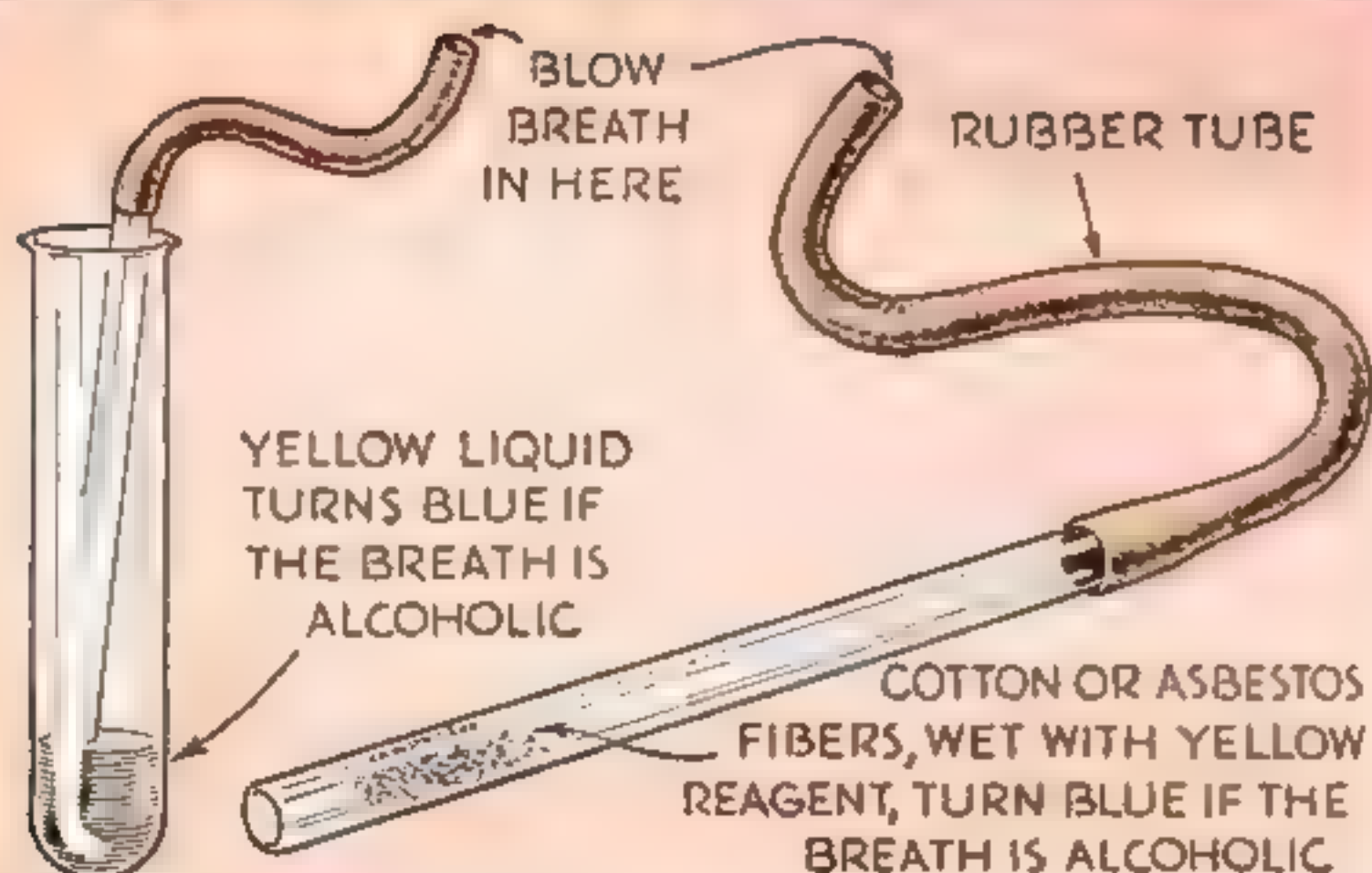
The tuning coil is a standard, A.C.-D.C. midget antenna coil with a high-impedance primary. Its shielding should be removed. Wind fifteen turns of No. 34, double-silk-covered wire around one end of the secondary coil (L_2), in the same direction as the coil winding, to serve as a tickler (L_3). The set is tuned by a small .00042-mfd. variable condenser. On the sloping panel of the 2" by 1 3/4" aluminum chassis, mount a midget 15,000-ohm volume control and switch. This is placed across the tickler coil (L_3), with its rotating arm bypassed to ground through a .00025-mfd. mica fixed condenser, to control regeneration. A good antenna should be used for best results, but a ground is not always necessary.



LIST OF PARTS

Volume control with switch, 15,000-ohm.
 Resistor, 3 meg., 1/2 watt.
 Fixed condensers, mica, .00015 and .00025 mfd.
 Tuning condenser, .00042 mfd.
 Four standard flash-light cells.
 Midget 45-volt "B" battery.
Miscellaneous.—Aluminum chassis, acorn tube (955), A.C.-D.C. broadcast antenna coil, acorn-tube socket, knobs, dial plate, phone-tip plugs and jacks, wire, etc.

Home-Laboratory Tests with ALCOHOL



To check a motorist's breath for alcohol, police have devised foolproof tests. A simplified version is shown above

IF THE year were 1160 instead of 1938, you would undoubtedly try out in your home laboratory the chemical experiment that Magister Salernus described. He wrote, "Place in the curcubita (a kind of retort) one pound red wine, one pound powdered salt, four ounces native sulphur, four ounces tartar. The liquid distilling is collected. A cloth saturated with this liquid will maintain a flame without suffering injury."

What this early experimenter described was a simple way to make alcohol, by distilling it from wine. The stunt with the cloth is explained by the fact that enough water to wet the cloth and protect it from the flame was mixed with the alcohol recovered by his crude condenser.

One of the interesting experiments that you can perform with alcohol is to make it yourself, much as Salernus did. You can omit the salt, sulphur, and tartar that his directions call for; it was quite the fashion in those days to include queer and often needless substances in experiments and recipes. Simply distilling wine or fermented honey or molasses water will do the trick. But, if you prefer, you can use ordinary store-bought rubbing alcohol or other forms of grain or ethyl alcohol in the experiments that follow.

Any one of a number of simple tests will identify alcohol. Here are some effective ways:

To a solution of potassium bichromate—the exact strength does not matter—add several drops of sulphuric acid. Then introduce a few drops of alcohol and heat the mixture. A change in color from orange to a greenish hue betrays the presence of the alcohol. Chromium sulphate, one of the products of the interaction, is responsible for the green tint. The bichromate solution also oxidizes the alcohol, converting it into what is known as an aldehyde, and you will probably notice the peculiar odor of

BY RAYMOND B. WAILES



You can test various kinds of oil, and even identify them, by floating them on mixtures of alcohol and water of different specific gravities

this compound as it escapes into the room.

To detect the alcohol that serves as a solvent in tincture of iodine, heat a few drops of the brown fluid with the same amount of water and a pinch of baking soda. The color of the iodine will disappear, and the colorless solution that remains will contain the telltale yellow precipitate of iodoform.

If your alcohol is not too weak, you can also prove its identity by changing it into acetic acid. Pour several drops of the alcohol into a test tube, and then invert the tube and let the liquid run out. Place a strip of blue litmus paper in the tube, letting it become dampened by the alcohol still adhering to the glass. Now insert a household gas lighter of the "magic" type obtainable at kitchen-supply counters,

which employs a filament bearing a bit of rare metal within a protecting coil of wire. The rare metal will act as a catalyst, or chemical go-between, enabling the alcohol vapor surrounding it to combine with the oxygen of the air and form acetic acid. In the presence of this acid vapor, the litmus paper turns red.

A reagent that you can easily make will change color from yellow to blue when warmed with a liquid containing alcohol. Prepare a solution of potassium chromate of fif-

teen-percent strength, or about the proportion of one teaspoonful of the chemical to nine teaspoonfuls of water. Also prepare a separate solution by mixing strong nitric acid with glacial (100-percent) acetic acid in a one-to-nineteen proportion by volume—say, five cubic centimeters of nitric acid to ninety-five cubic centimeters of acetic acid. For use, add two drops of the potassium chromate solution to ten cubic centimeters (or about three teaspoonfuls) of the acid mixture.

Chemical tests are coming into vogue among police of various cities to determine whether motorists and others have been drinking alcoholic beverages. One simplified form of such a test employs no more apparatus than a glass tube a quarter of an inch in di-

Measuring Chemicals Without Weights Or Graduates

EVEN if your laboratory lacks accurate weights and graduates, you can measure out chemicals in the right proportion for your experiments.

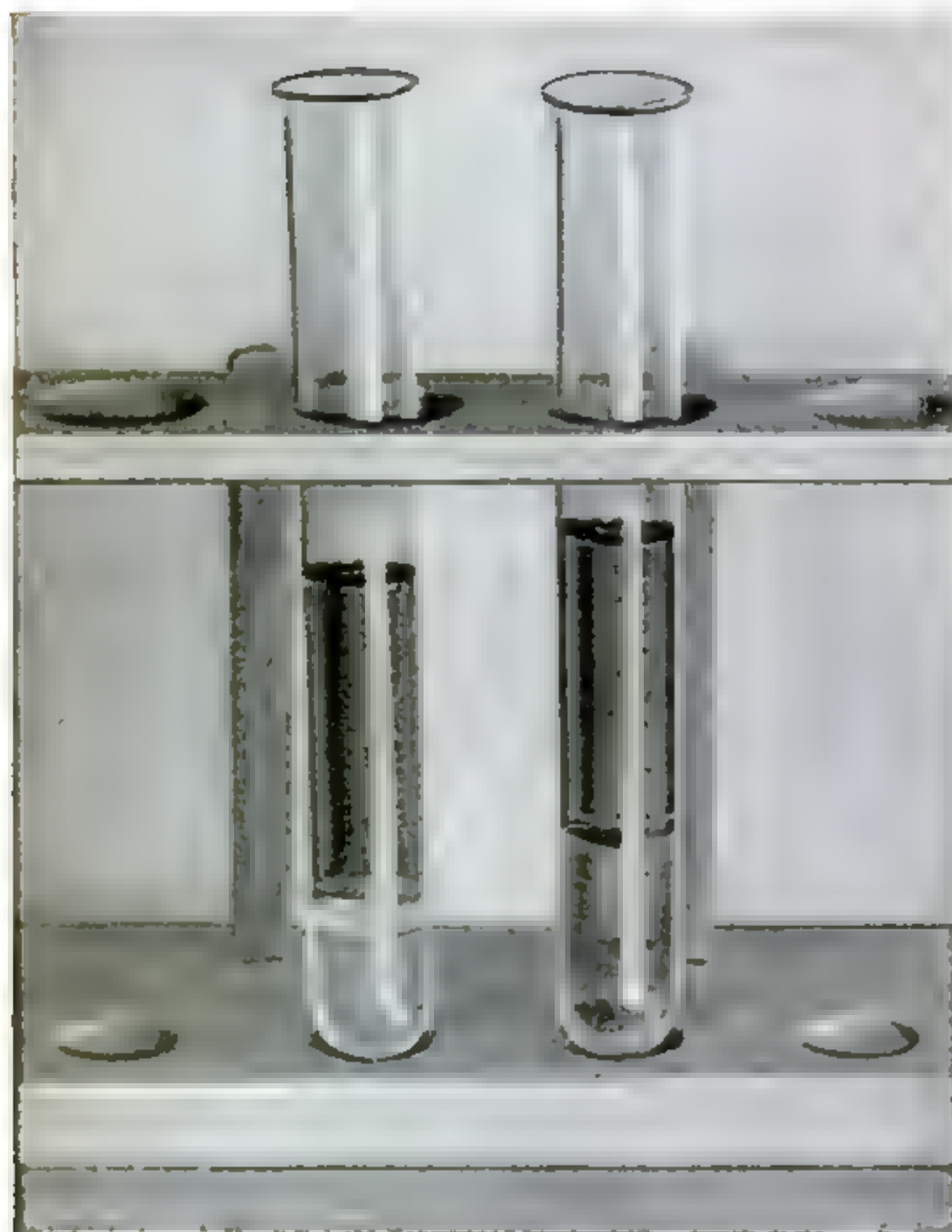
To measure out dry, powdered chemicals in grams, it usually is sufficiently accurate to consider that one teaspoonful equals 5 grams.

If you have a scale, but lack the weights, you can weigh chemicals with money. A dime weighs $2\frac{1}{2}$ grams; a penny, 3 grams; a nickel, 5 grams; a quarter, $6\frac{1}{4}$ grams; and a half dollar, $12\frac{1}{2}$ grams. Thus, nickels or dimes alone will provide you with 5, 10, 15, 20, and 25-gram

weights; or, for the last, you could use four quarters or two half dollars. With a little ingenuity you can work out your own table of combinations of coins.

To measure out a small fraction such as 0.2 of a gram, make a square, evenly distributed layer of 5 grams of the chemical upon a sheet of paper. Divide the square into 25 smaller ones, and each small square will then contain 0.2 grams.

For measuring liquids, one drop equals 0.06 c.c., or cubic centimeters; one teaspoonful, 3.5 c.c.; one tablespoonful, 15 c.c.; and one drinking glass or tumblerful, 240 c.c.



Commercial chemists detect artificial coloring in alcoholic liquors by mixing a sample with amyl alcohol, phosphoric acid, and water

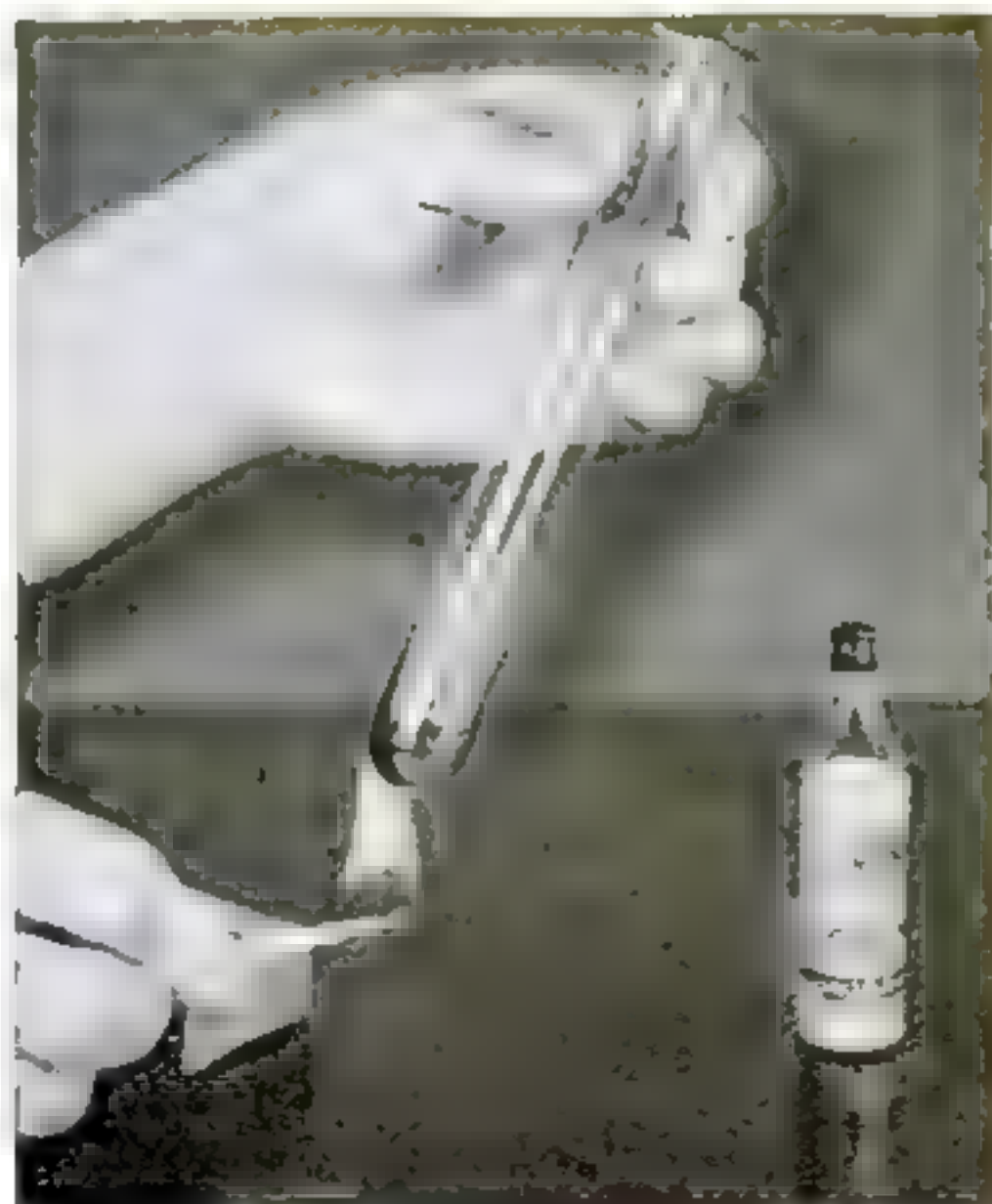
ameter and six or eight inches long, containing a loosely fitting wad of absorbent cotton or asbestos, and fitted with a piece of rubber tubing. The subject is required to exhale through the tubing for half a minute or so. If there is alcohol in his breath, a drop or two of a detecting fluid that has been placed on the cotton or asbestos will change color. For example, the chromate-and-acid reagent just described would serve this purpose, and would plainly show that the subject had had an alcoholic drink if it changed from yellow to blue. The test could be varied by placing a little of the reagent in a test tube and having the subject blow his breath directly into it, through a glass tube, for a minute or so; the color change would require longer to appear but should be more pronounced.

When it comes to analyzing alcoholic liquors, professional chemists employ a variety of more or less complicat-

ed tests, but one of the questions they may be asked—whether whisky and similar liquors are synthetic concoctions—is surprisingly easy to answer. A ten-cubic-centimeter portion of the whisky is shaken in a test tube with two cubic centimeters of water. The chemist next adds fifteen cubic centimeters of a liquid called Marsh's reagent, prepared by mixing 100 cubic centimeters of amyl alcohol with three cubic centimeters of sirupy (eighty-five-percent) phosphoric acid and three cubic centimeters of water. Then he lets the contents of the test tube settle. If a clear, water-white layer of liquid collects at the bottom of the test tube, this shows that the whisky has been allowed to age naturally and that its color has been derived entirely from the wooden barrel. But if the liquid that separates to form the bottom layer is colored brown, it proves that artificial coloring such as caramel has been used—in a "rye" flavoring added to an alcohol-and-water mixture, for example—and that the liquor is synthetic.

A TRICKY little "sink-or-float" test employing alcohol will identify various kinds of oils by their specific gravity—that is, the amount by which they are lighter than water. For example, olive oil and cottonseed oil look alike and might be mistaken for each other. But olive oil has a specific gravity of about 0.915, and cottonseed oil of about 0.925, meaning that they are respectively 915 one-thousandths and 925 one-thousandths as heavy as water. Now, by adding more or less water to alcohol, which is considerably lighter than water, you can vary the specific gravity of the mixture at will. Thus you can readily obtain an alcohol-water solution in which the heavier of two oils will sink and the lighter one will float, making it easy to tell them apart.

Alcohol Test Produces Iodoform



BY MIXING alcohol, iodine, and an alkaline liquid you can compound the antiseptic substance called iodoform. Place a small amount of alcohol in a test tube, add a few drops of a solution of sodium hydroxide or potassium hydroxide and a small crystal of iodine, and heat it gently. A yellow powder, iodoform, will be precipitated. This experiment can be used as a test for the presence of alcohol.

Suppose you want to find out whether a bottleful of oil is olive oil. Place about five cubic centimeters of rubbing or grain alcohol in a test tube. Put in a drop of olive oil—not from the doubtful sample, but from a source you are sure of. Add water drop by drop, stirring the liquid after each addition, until the olive oil floats. At this point, introduce a drop of the unidentified oil for comparison. If it sinks, you know at once that it is not olive oil. But if it floats, it may be either olive oil or some lighter oil. In this case, add alcohol drop by drop until the globule of olive oil sinks. If the other one sinks at the same time, you may be reasonably sure it is olive oil; if it remains afloat, it is not. In the same way, by comparison with known samples, you can easily identify cottonseed oil, castor oil, and a variety of others.

When you add measured volumes of alcohol and water to each other, you might expect the total volume to equal the sum of the two portions. But here is a case where two objects seem to be able to occupy the same space—for actually a measurable shrinkage occurs upon mixing. To show this, half fill a fifty-cubic-centimeter burette with water, closing the outlet by the stopcock or pinch clamp at the bottom. Carefully add alcohol, so that it does not mix with the water but floats upon it, until the zero mark at the top of the burette is reached. This will have required twenty-five cubic centimeters apiece of water and alcohol, or a total of fifty cubic centimeters.

Now stopper the top of the burette and invert it several times to mix the liquids. Set the burette upright again, remove the stopper, and note the new level of liquid in the graduated column. It will have fallen noticeably below the zero mark. A typical trial of this experiment showed a drop corresponding to a shrinkage of 0.8 cubic centimeters.

PURE alcohol burns freely, with a bluish, almost colorless flame. If an equal volume of water is added, the mixture will still burn, leaving a residue of water. Continued addition of water, however, makes an alcohol-water mixture impossible to ignite, and the ease with which alcohol will burn therefore gives a rough test of the amount of water it contains. In earlier times, to test alcohol for water, a small amount of gunpowder was moistened with the liquid and the alcohol was ignited. If the gunpowder burned, the alcohol was considered of acceptable strength or



Some liquids shrink when mixed. You can show this by putting alcohol and water in a glass burette

“proof.” If the alcohol contained too much water, the gunpowder would remain wet and would not be ignited by the burning liquid, which would then be rated “under proof.” Thus originated the name of “proof spirits” by which ethyl alcohol is sometimes designated.

Names are important to keep straight in the alcohol family, by the way, since many different kinds of alcohol are known to chemists, and a single kind may masquerade under several different labels. Ethyl alcohol, grain alcohol, and proof spirits mean the same. As usually manufactured, ethyl alcohol varies in purity between ninety-four and ninety-six percent, the rest being water. “Absolute alcohol” is 100 percent alcohol; it is made by treating ninety-six-percent alcohol with dry lime and then distilling the product, which is carefully protected from the moisture of the air.

Methyl or wood alcohol, which has the additional alias of “Columbian spirits,” is a different chemical compound from ethyl alcohol. Hence it has a different set of properties, including its poisonous nature.

Still other distinct compounds bearing the name of alcohol include amyl alcohol, propyl alcohol, butyl al- *(Continued on page 250)*

Life in

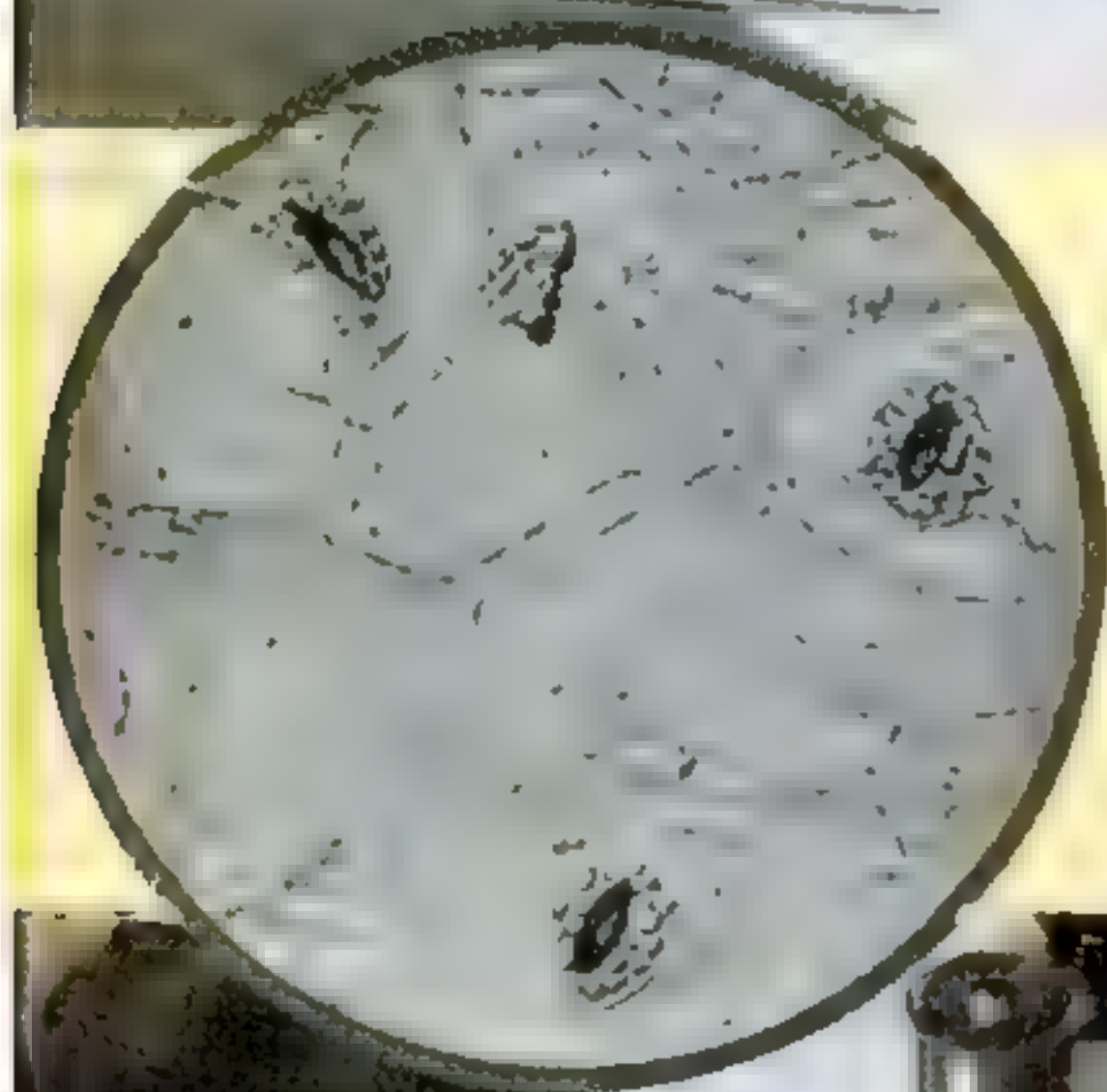
By
**MORTON C.
WALLING**

THE leaf of almost any outdoor or house plant can provide no end of fun for the owner of a compound microscope, and it is one of the easiest objects to procure and to handle during observation. Here, again, as in so many by ways of nature, you can see evidences of an amazing ingenuity, and find proof that some of man's "newest" inventions really are ages old.

A typical leaf is made up of three parts: the colorless veins that form the framework or skeleton; the chlorenchyma, or collection of green cells, that make up the bulk of the leaf; and the epidermis that forms a protective coating for the veins and chlorenchyma.

Briefly, the veins, which are similar in structure to the stems of the same plant, consist of angular cells arranged in three groups consisting of first, the sieve tubes and cells associated with them, which carry proteins manufactured in the leaf back to the stem of the plant; second, the bundle sheath encircling the other parts of the vein, whose cells carry sugar from the leaf back to the plant stem; and third, the ducts which form the water system of the leaf, carrying the fluid from the plant stem to the various parts of the leaf structure.

With your microscope, you can explore with ease the veins of almost any leaf that is not extremely thick, simply by placing the specimen on a glass slide and directing a strong light through it with the sub-stage mirror. The veins form



Spines, hairs, or scales found on some leaves can be scraped off with a safety razor for microscopic study. Below, a leaf put on a slide under strong light. At left, underside of a begonia leaf as viewed in this simple manner



a Leaf

SEEN THROUGH YOUR MICROSCOPE

an irregular, colorless network through the field of green. (In some leaves color is visible in the veins, but generally they are colorless.) For a cross-sectional view showing the bundles of cells forming the veins, slice a leaf crosswise into very thin sections with a razor, using a piece of blotter or sheet of cork for a chopping block. Mount the sections in water under a cover glass for observation. If you want to remove the green coloring matter from a whole leaf or sections, thus making the cells more nearly transparent, soak the specimen in warm alcohol.

The chlorenchyma is composed of transparent-walled cells most easily distinguished by the presence of disk-shaped chlorophyll grains, bright green in color. Present also in the cells of the chlorenchyma is the protoplasm, a gelatinlike part of the cell in which life reposes, and a quantity of sap, which is essentially water containing sugar in solution. This sap usually is under considerable pressure within the cells, as you can determine by making razor cuts across some of the more watery-looking leaves.

Under the microscope, the most prominent part of the chlorenchyma is, of course, the collection of chlorophyll disks. These are highly important bits of matter to the leaf, for they make possible, in a way that in some respects is still a mystery, the transformation of water, carbon dioxide, and sunlight into starch and sugar that the plant can use for food, accompanied by a release of oxygen. This process is called photosynthesis.

The third portion of the leaf, the epidermis, is in many ways the most interesting to the amateur microscopist. Among the reasons is the fact that it contains the stomata and any hairs, spines, or scales that may be present. It is also just about the easiest part to prepare for microscopic examination.

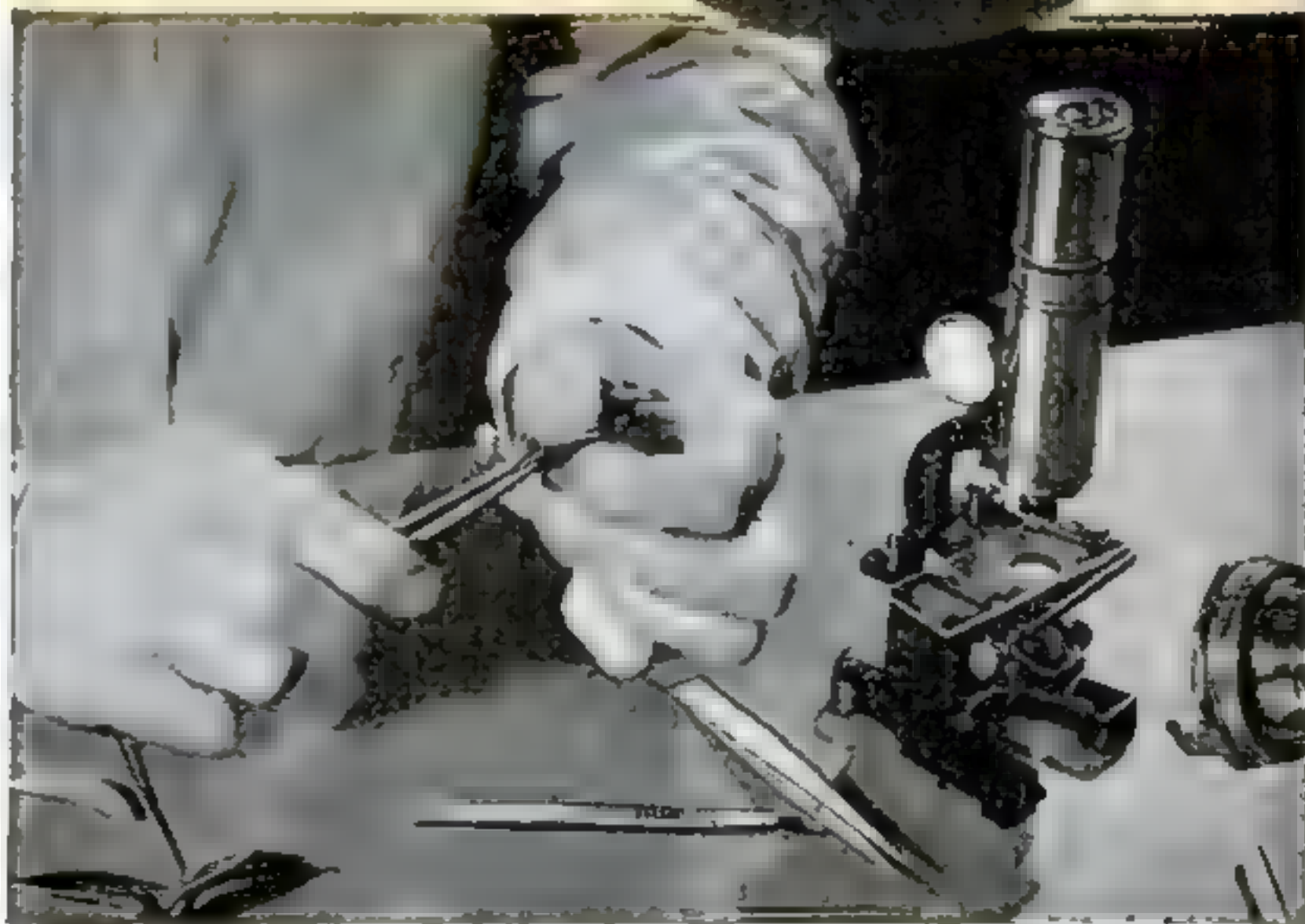
Structurally, the epidermis is made up of a single layer of colorless cells that are waterproofed with a substance called cutin. Thus the familiar leaf was manufacturing, millions of years ago, a transparent, waterproof, cellulose-film wrapping material with



Epidermis being peeled from an iris leaf. Left, begonia-leaf epidermis as seen through the microscope, showing stomata and their guard cells



By folding a leaf sharply, as seen below, hairs and spines are thrown into sharp relief. The photomicrograph at right shows spines on a hollyhock leaf





Cross sections of any thick leaf are made by slicing it with a razor. Such a section is seen at the left. The dark mass is one of the leaf's veins

which to protect its precious insides. Today, you can purchase man-made cellulose film in sheet form, for wrapping cakes, candies, and Christmas packages. It is fairly new among modern industrial products, but the leaf was making virtually the same thing long before the human race cared about wrapping anything.

Because the epidermis of a leaf is a tight and waterproof wrapper, and because it is necessary for the leaf to take in and discharge carbon dioxide and oxygen, the epidermis is pierced by numerous tiny valves called stomata. Usually these occur on the underside of the leaf, where they won't become clogged by rain water.

With your microscope set at about 200 diameters, you can observe the stomata on most leaves, particularly those of the common maple-leaf begonia, Wandering-Jew vine, and iris. Of these the begonia is perhaps the best, for its stomata stand out with startling clarity, when illumination is right. Simply place the leaf upside down on a

microscope slide and focus on the bottom epidermal layer (which is now uppermost) while it is illuminated by a strong light coming through the leaf from the substage mirror. For a better view of the stomata, peel the epidermis from the leaf with the aid of tweezers and a sharp scalpel, and spread it out on a slide, in a drop of water, with a cover glass to hold it flat. You will find it easier to peel the epidermis from some leaves than others.

The stomata you will see scattered fairly regularly over the leaf surface will appear somewhat like tiny grains of wheat. Essentially, each consists of a slitlike opening flanked by two guard cells that, together, are oval or circular in shape. You may be able to observe that some of the slits are practically closed, while others are open wide, sometimes being almost circular in form. The two guard cells control the opening and closing of the slit, and thus regulate

the passage of gases, including water vapor, through the epidermis. If the stomata were open all the time, too much water might be lost. Again, it would not be necessary to keep them open at night, when the leaf cannot manufacture food because there is no sunlight.

To make food, a leaf requires carbon dioxide from the air. But this gas cannot penetrate the epidermis, except through the stomata. Likewise, oxygen resulting from the food-manufacturing process cannot escape except through the stomata. The chlorenchyma, where the food-making activity is centered, is at all times saturated with water, except in a dead leaf. When the stomata are open, some of this water naturally escapes.

BOTANISTS have decided that the guard cells open and close the stomata slits in accordance with the amount of water affecting them. Thus, when there is an abundance of moisture, the guard-cell walls stretch and the slits open. When there is little moisture in the cells, the walls become taut, and draw the slits to a close. Thus, automatically, loss of too much water is prevented.

There is another clever mechanism for help-

AMONG THE COMMONEST AND MOST ACCESSIBLE OF MICROSCOPE SUBJECTS, LEAVES REVEAL TO YOUR MAGIC LENSES AMAZING SECRETS OF PLANT LIFE

ing control the opening and closing of the stomata. Peel a layer of epidermis from the underside of a begonia, iris, or other leaf, and examine it carefully at 200 or more diameters. You will discover that the guard cells contain green disks of chlorophyll, but that the surrounding cells are colorless. Thus the guard cells, like those in the chlorenchyma, have the power of photosynthesis—the ability to manufacture grape sugar or dextroglucose, under the stimulus of sunlight. By the process of osmosis, a solution of grape sugar draws water to itself from surrounding sources when contained in a membrane-walled vessel. Thus the guard cells, when sunlight is affecting them, manufacture sugar, which helps to draw water into them from surrounding, sugarless cells. This increase in water causes the stomata slits to open, admitting carbon dioxide so photosynthesis can proceed in the chlorenchyma.

Hairs, spines, and scales are easy to observe on the leaves that possess them. The hollyhock has a spined leaf. At 100 diameters or so, you can observe the numerous tufts of glasslike spines covering both sides of the leaf. There usually are six or seven in each group, arranged generally in a circle, all pointing outward from the leaf at an angle. These spines occur abundantly along the veins. A great many other leaves have similar spines or hairs. The upper surface of a begonia leaf usually has several hairs, each composed of a number of cells tied in with the rest of the epidermis in a clever manner.

Such spines and hairs often give the leaf a rough appearance and feeling when present in considerable numbers. Therefore, to find them, select leaves having those

characteristics. In extreme cases of development, such as the cactus and thistle, epidermal spines are prominent and effective implements of protection. They also definitely affect the appearance of the leaf, as in the case of a dark-blue or black pansy petal. Yes, a petal is essentially a leaf!

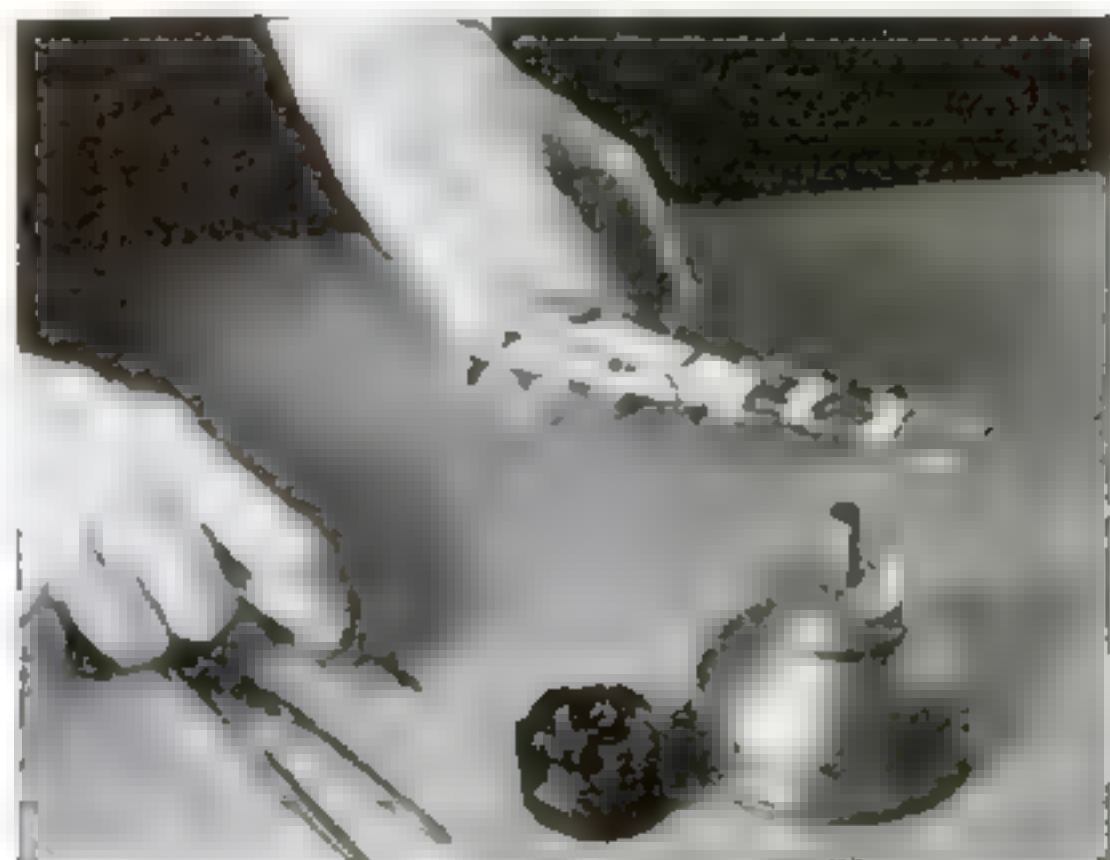
Under your microscope, you will see that a pansy petal of *(Continued on page 252)*

How To Make Durable Liquid Mounts

SPECIMENS mounted in glycerin or other liquids will last for years if carefully stored and handled, but they are easily damaged. To make a liquid mount that will stand hard usage, follow the method illustrated in the accompanying photographs. The metal piece can be from $\frac{7}{8}$ " to 1" wide, and from 1" to 3" long. An easy way to cut the hole is with a carpenter's spur bit. Cemented to the slide, the metal plate forms a protective cell in which the specimen is placed in the liquid. The cover glass fits snugly in the hole, and the cell is sealed with asphalt varnish, shellac, or other suitable material, applied by hand or with a cell-spinning wheel as shown.



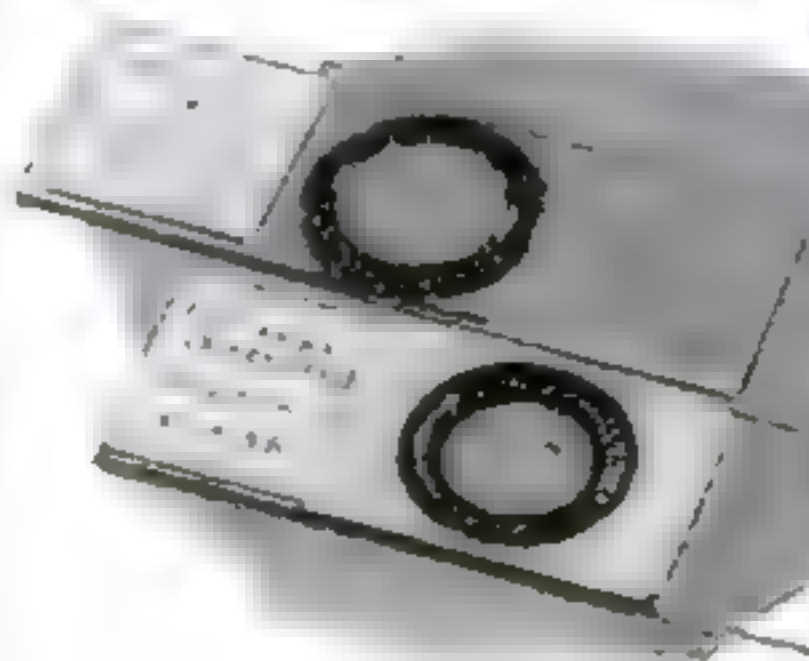
Cut a rectangle from a sheet of aluminum, and make a hole in it slightly larger than the cover glass to be used



Cement the metal to a slide with warm shellac or with marine glue, a tarlike material that is heated to make it set



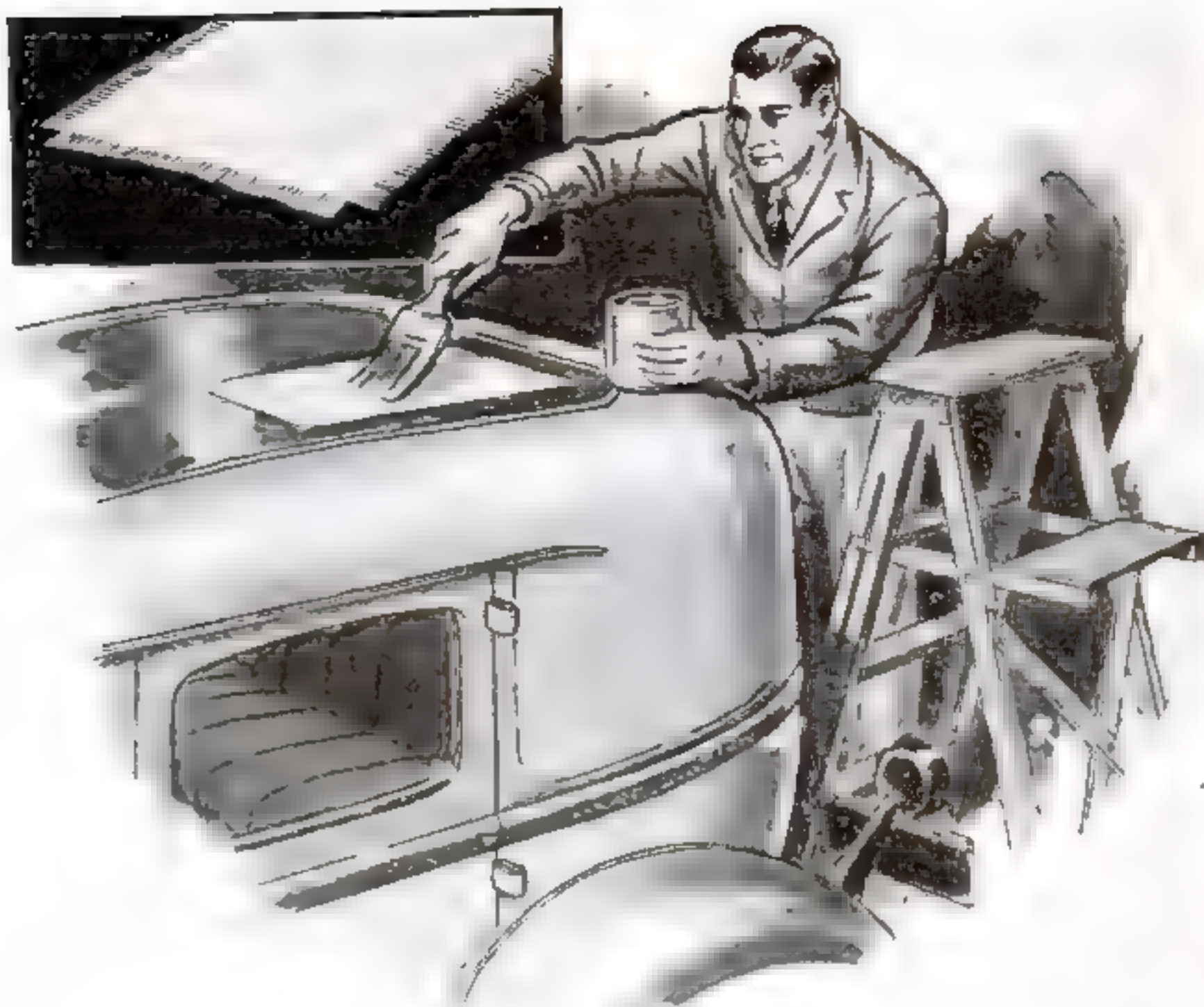
Arrange the specimen in glycerin, put on the cover glass, and ring the cell. At left, the job is compared with a regular cell



New Ideas FOR Motorists

Airplane Dope Holds Car-Top Patch

TO MAKE a muslin patch on a car top stick tighter, make a fringe around the edge of the patch before applying it. Pulling away the threads one by one accomplishes this, as shown at the right. Clean the area around the leak and apply a coat of airplane-wing dope. Then lay the patch on the area, and make a second application of the dope. —W.R.



How the frayed patch is applied. The fringe, seen in the inset, lies flat and anchors the patch tightly in place

Parts Tray and Tool Rack Made from Old Tire

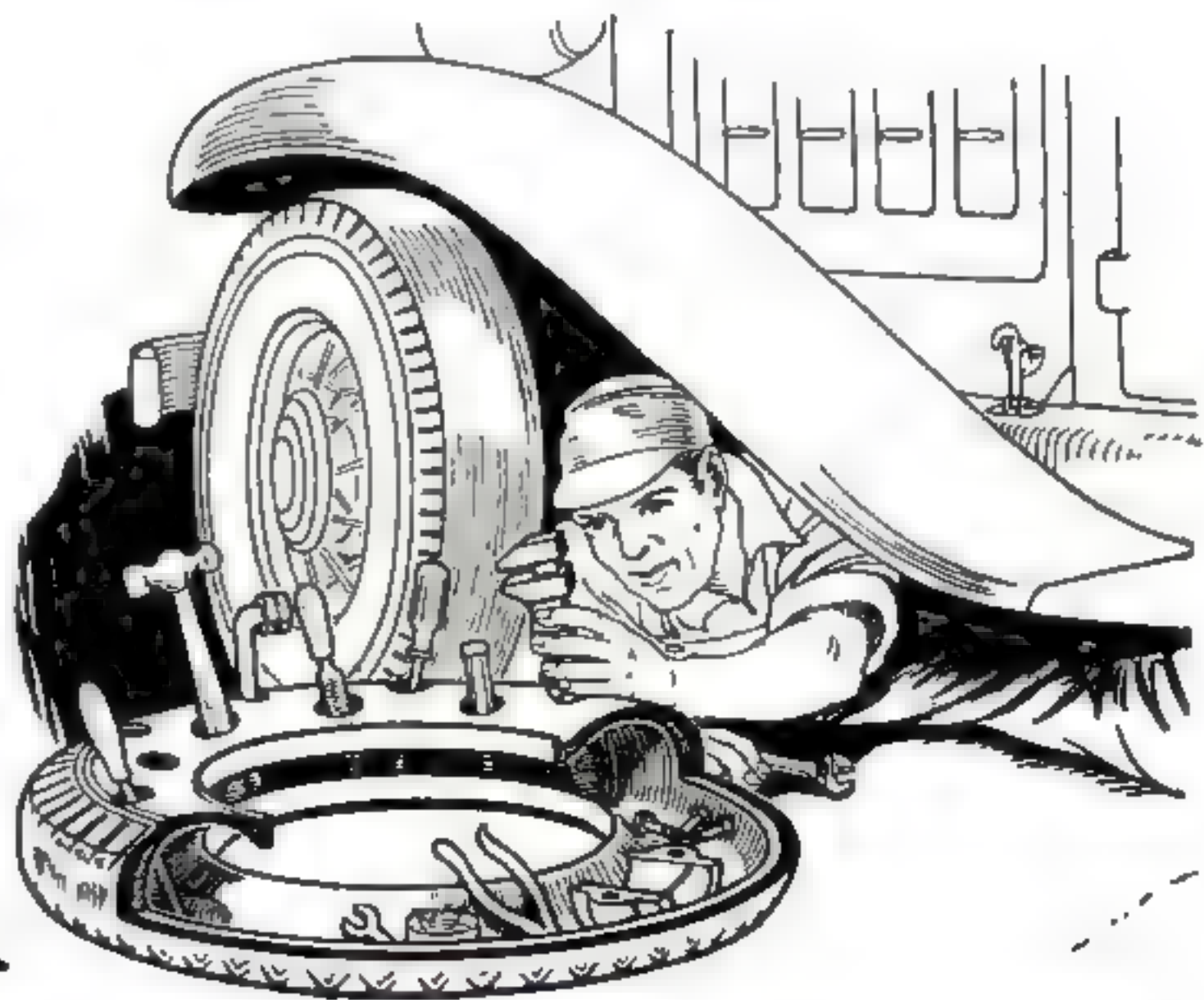
IT TAKES about five minutes with a hack saw and knife to cut away enough of an old tire casing to make the handy parts tray and tool holder depicted below, for use during car repairs. Lay the tire flat and saw halfway through it at points about opposite to each other. With a knife, then cut halfway around the center of the tread. Drill holes for tools in the section of the tire that is not cut away. The accessory will be found particularly useful for repair jobs close to the floor, especially those that require the user to work under the car. —A.H.W.

Handy Repair Table Aids Motor-Overhaul Jobs

TO MAKE it easy to keep track of each piston, connecting rod, and pair of valves during an engine overhaul, I built the table shown above. It is high enough to keep the longest connecting rods off the floor, and the groups of three holes in the top allow for inserting the rods and valve stems in sets in the order corresponding to that in which they came from the motor —E.H.

Sun Visor Directs Breeze

ON UNUSUALLY warm autumn days, the summer-time trick of lowering a car's sun visor slightly to deflect the breeze coming through the open windshield onto the face, is a boon to the perspiring motorist. —D.V.S.



When working under a car, the motorist can keep the handy tray near at hand. It is made of an old tire

FOR *Thrills* OF A LIFETIME

A NEW
1939
HARLEY-
DAVIDSON

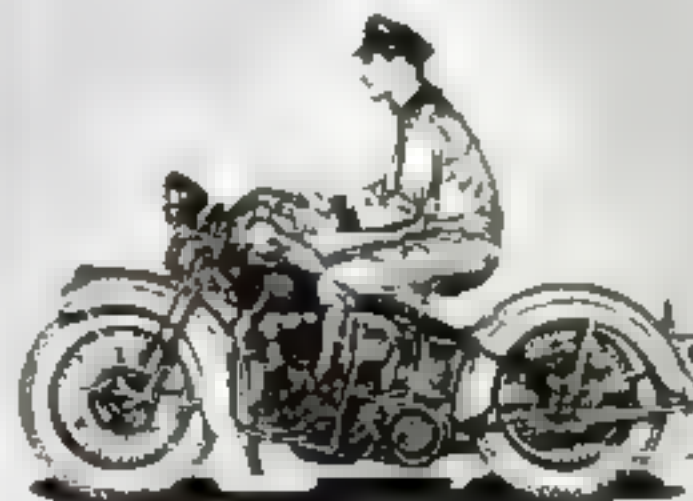
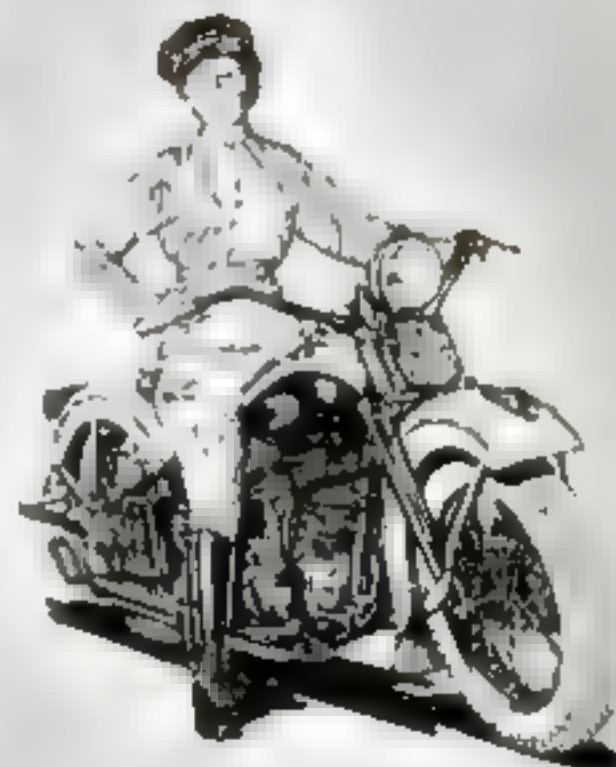


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HERE'S first news of the great 1939 Harley-Davidson motorcycles—packing great thrills for the red-blooded, sports-loving, outdoor enthusiast. Improved motor performance — still lower upkeep—super-streamlined design—classy appearance — striking new color combinations — and many other outstanding features and refinements. A "mount" that opens up a whole new world of fun and excitement in that greatest of outdoor sports — motorcycling. Be one of the first to ride a new 1939 Harley-Davidson — have lots of good times — see the sights — make new friends — go on jaunts with other happy riders. Go in for gypsy tours — hillclimbs — reliability runs and other thrilling events that provide more real pleasure than you ever dreamed possible.

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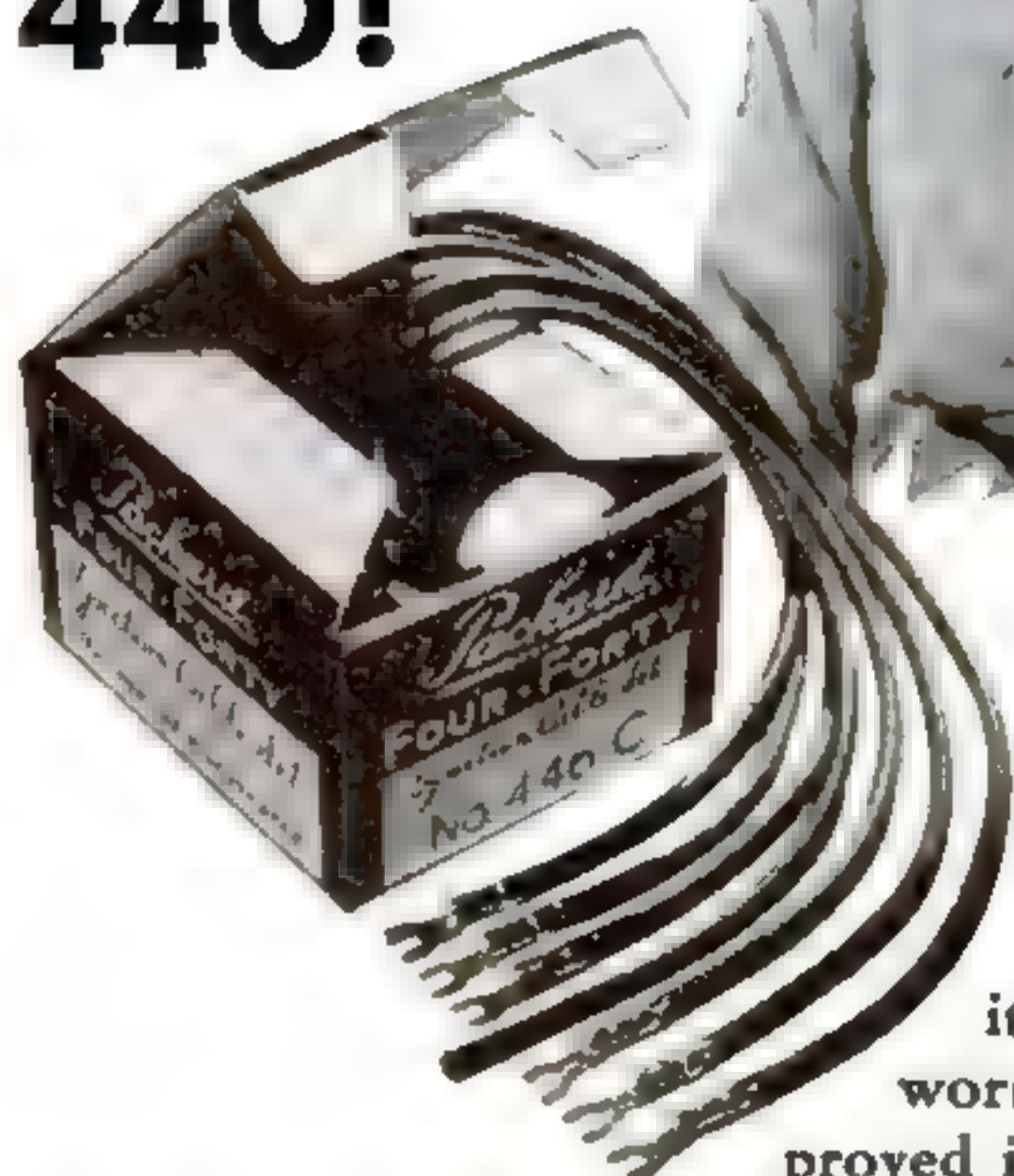
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EVERY 10,000 TO 15,000 MILES?

You bet!

AND MAKE SURE
YOU GET

**PACKARD
440!**



● "Sure, I know
it's better to replace
worn-out wires—I've
proved it on my own car.

And every customer who comes into our shop for a tune-up gets new Packard Four-Forty, if his old cables are hardened or oil-soaked—as they usually are!

"I've worked over motors for a long time, putting them in shape for long summer trips, tuning them up for winter driving, and improving their performance and economy of operation. And I know that nothing else I do to a motor will put it in A-1 shape if the spark plug wires are wasting juice—causing cross-firing and fouling spark plugs.

"I insist on Packard Four-Forty because it's the first cable I ever saw that can 'take' the heat under that hood in hot weather . . . remain flexible and crack-free under the cold of winter months . . . and still withstand the effects of corona, age, oil and abrasion after miles of high-speed driving.

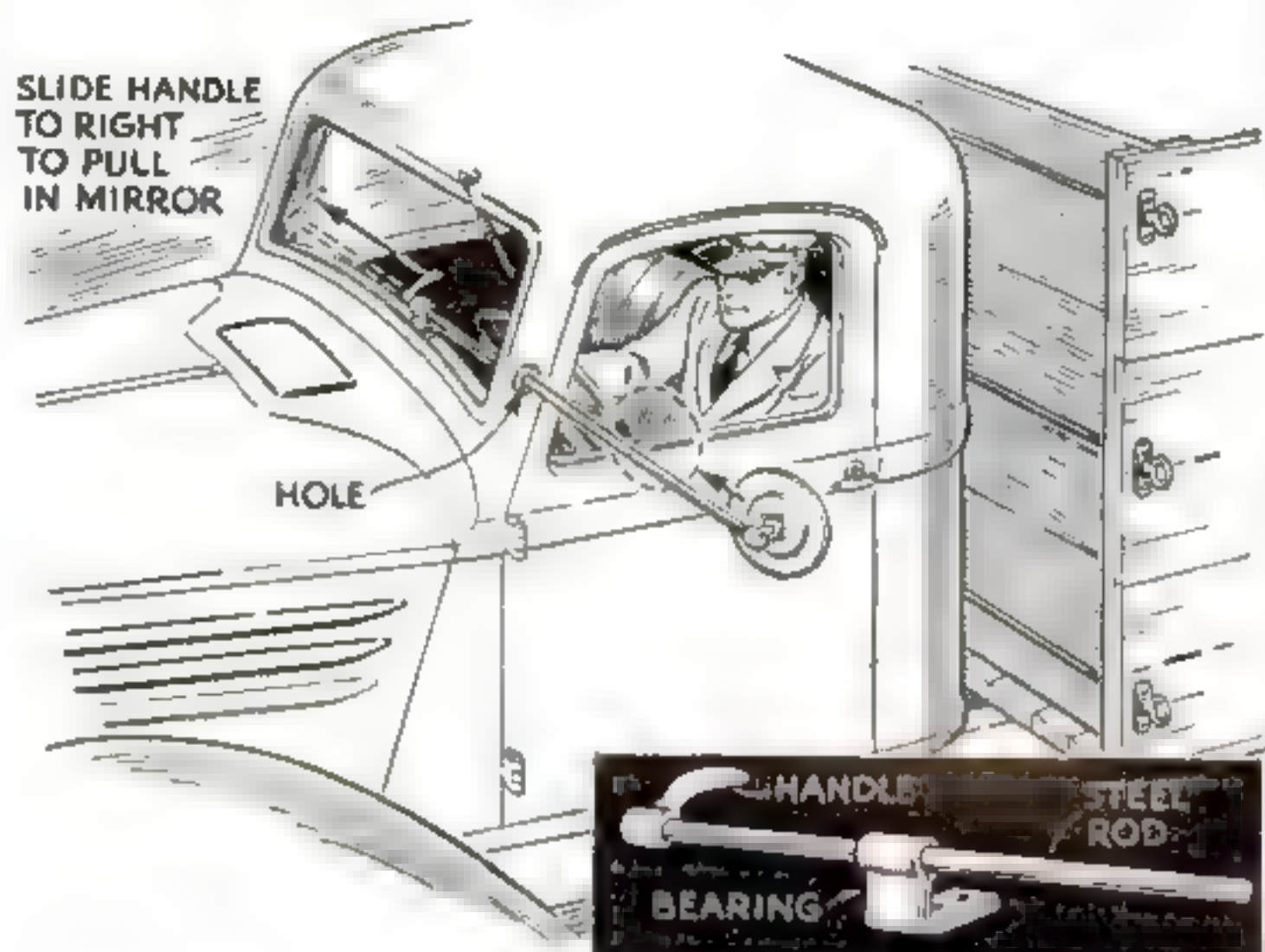
"I needn't go into all the details about Packard Four-Forty's secret-formula inorganic sheath—just take my word for it. I know what I'm talking about—and you'll agree with me, after you see how much better your car runs with a new set of Packard Four-Forty!"

Packard Four-Forty Ignition Cable Sets for any car are available at most service stations. Install a set NOW. The cost is low and you'll benefit by faster pick-up, more power and lower gasoline bills. Packard Electric Division, General Motors Corporation, Warren, Ohio.

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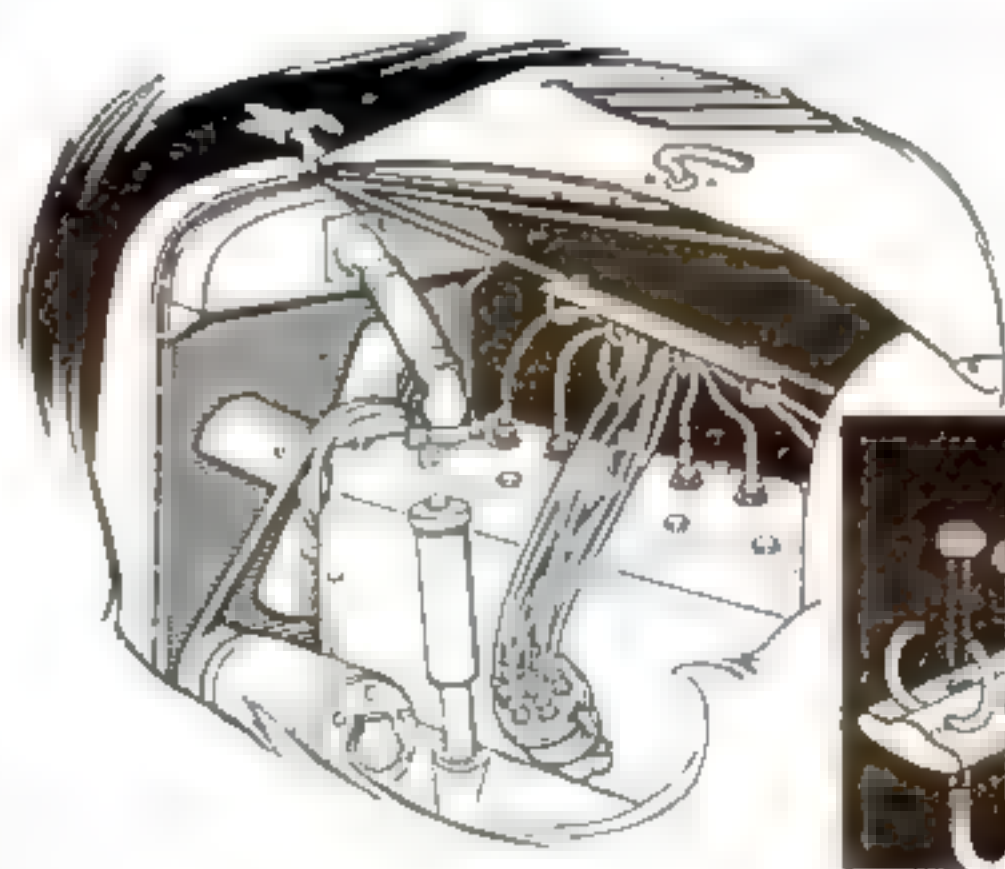
Timely Aids for Motorists



Extension Mirror Helps in Parking Big Truck

DRIVERS of large trucks or trailers will find the extending rear-view mirror shown above an aid when backing or parking. The mirror is attached to an extension rod that passes through a hole in the windshield frame. Ordinarily, the mirror is set in normal driving position close to the truck body. For backing, the handle on the inside end of the rod is pushed to the left as far as it will go to extend the mirror for better vision of a loading platform or the curb.—A.H.W.

Notebook Binder Fastens Ignition Wires in Place



How the back
of loose-leaf
notebook holds
ignition wires

TO SIMPLIFY inspection and removal of the distributor-to-plug ignition wires in my car, I replaced the conventional metal-tube holder with the spring back and rings of an inexpensive loose-leaf notebook. After removing the covers from the metal unit, it is an easy matter to clamp it to one of the radiator stay rods. Bunch the ignition wires, insert them in the open rings, and snap the rings shut to hold them securely in place, as shown in the illustration above.—W.H.

POPULAR SCIENCE

Enjoy the sense of security this "Power-House" can give you

A NEW BATTERY

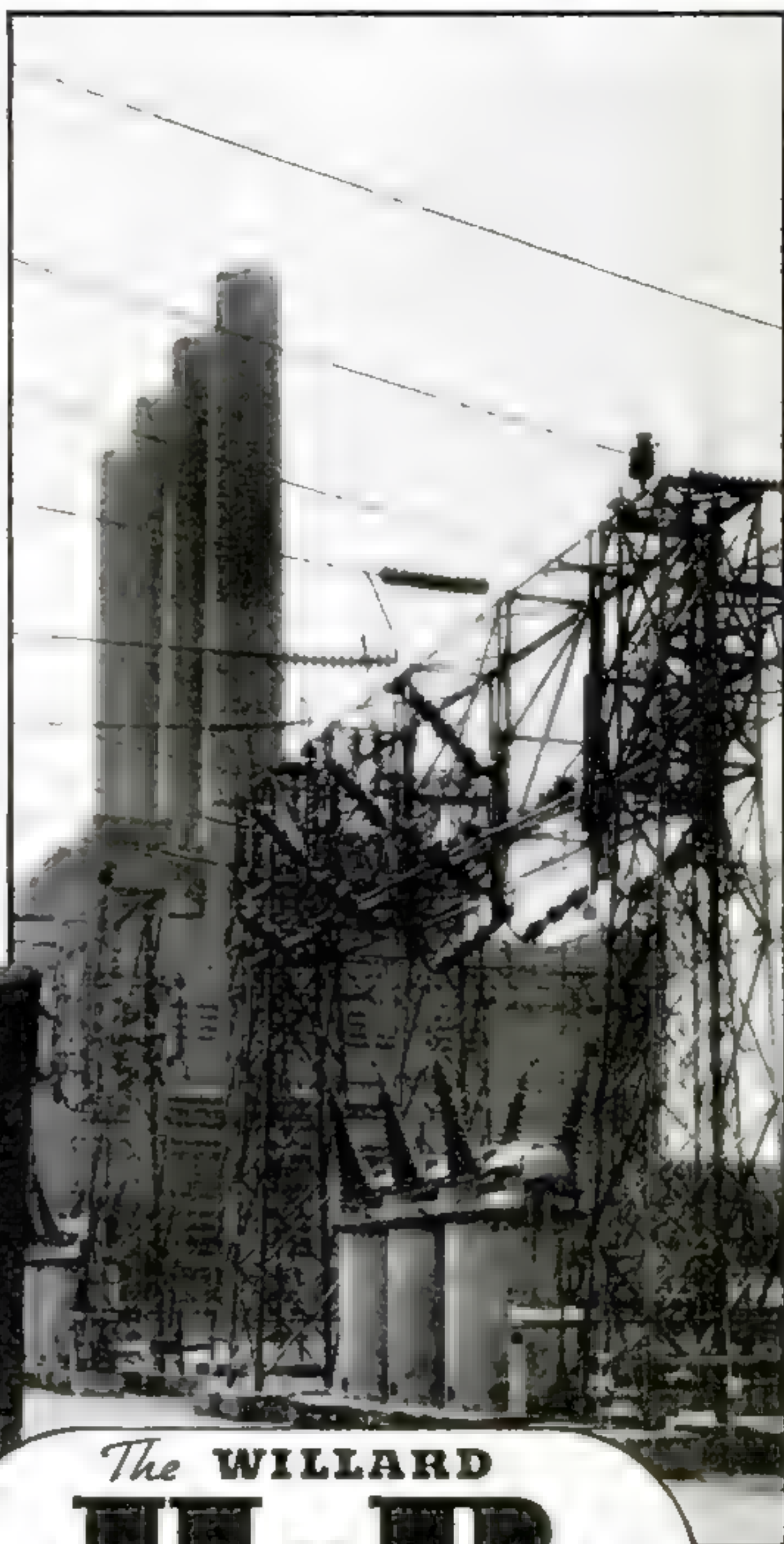
THAT LASTS 68% LONGER!

There's something new in automobile batteries!

It's called the Willard "H-R"—and was developed by the country's leading battery engineers after a 9 year survey of how batteries perform under all kinds of driving conditions.

The "H-R" will do all the things you'd expect a good battery to do—and the actual records of 78,000 batteries prove that it will *keep on doing them 68% longer than the average of competing brands!*

Installed in your car, this new "Power-House" battery means more safety for you and your family, quicker starts for your car and longer life from your battery.



Here's Why the "H-R" Lasts 68% Longer

This amazing performance is due to new developments, exclusive with Willard. Most important single feature is the new Willard Thread Rubber Insulator. Inserted between the plates of the "H-R", these Thread Rubber Insulators not only increase the battery's life—

but protect you against the sudden failures so often caused by "shorts" or buckled plates.

Expensive? No,—the "H-R" costs no more than any good battery, and its extra months of life make it cost less to own. You'll be safer, and you'll save money, if you replace your present battery with a Willard "H-R" now.

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ASK FOR IT BY NAME AT

The WILLARD
H-R

YOUR WILLARD DEALER'S

THIS MAY UPSET ALL YOUR IDEAS

about Anti-Freeze

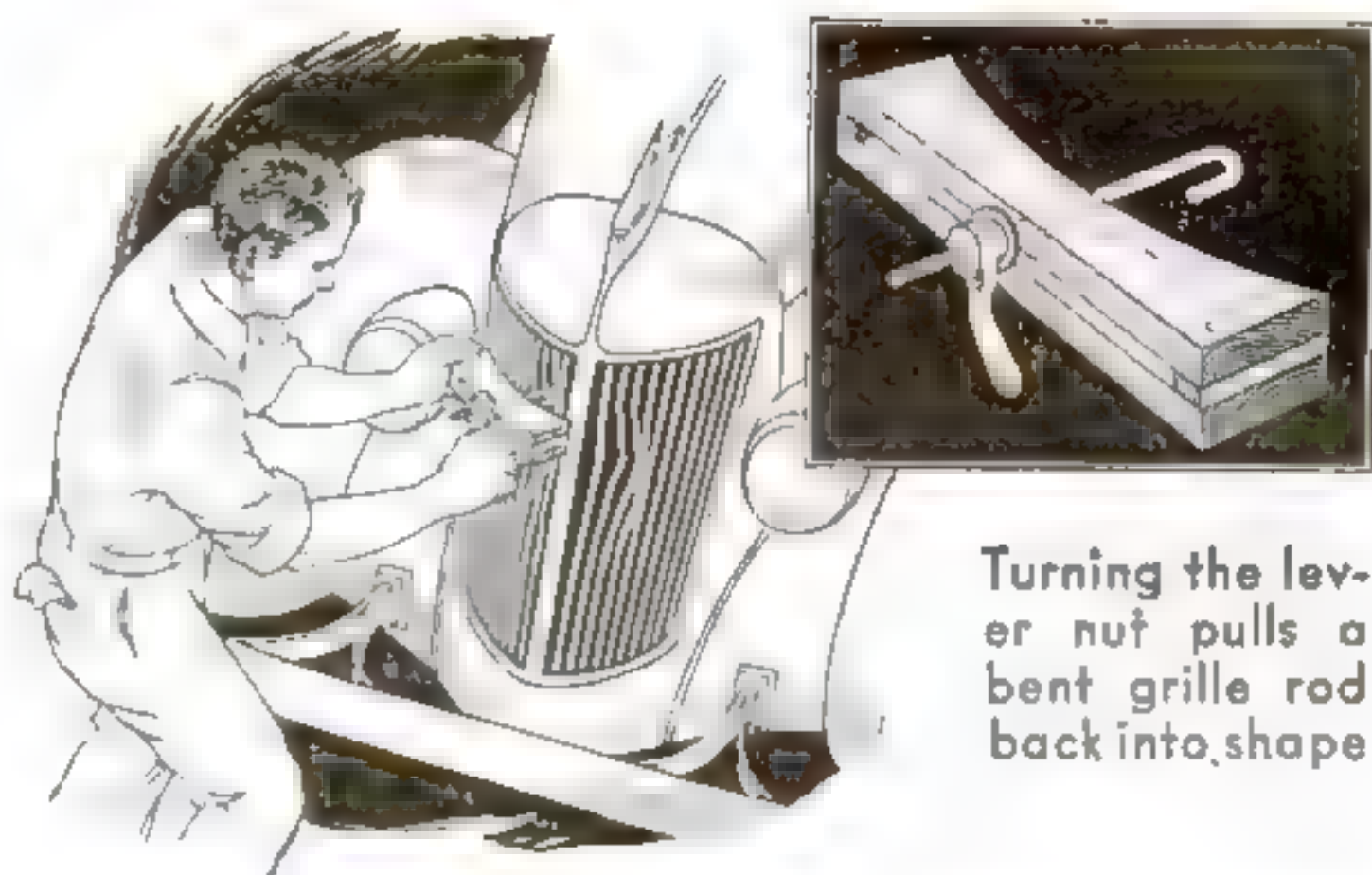
THIS anti-freeze story is contrary to long-established beliefs. Scientific tests prove that "Zerone" makes a perfect mixture with water and that you lose little or none by evaporation or separation. Radiator losses are due mainly to *mechanical causes*—leaks, sudden stops, etc. Where there is boiling, the losses are of the whole solution—"Zerone" and water—and such losses are in about the same proportions as the original protection.

First, use "Zerone" in accordance with directions on can or protection chart. Second, never assume that it's the water only, or "Zerone" only, that has been lost when your cooling solution is low. Check strength of the solution, and replace the indicated *combination* of "Zerone" and water, or you may have too much protection or too little.

The materials from which "Zerone" is made are so effective you need less for protection. Replacements, if any, cost you little. Remember, "Zerone" is only \$1.00 a gallon (\$1.20 west of the Rockies). Du Pont, "Zerone" Division, Wilmington, Delaware.



Hand Clamp Straightens Damaged Grille Rods



Turning the lever nut pulls a bent grille rod back into shape

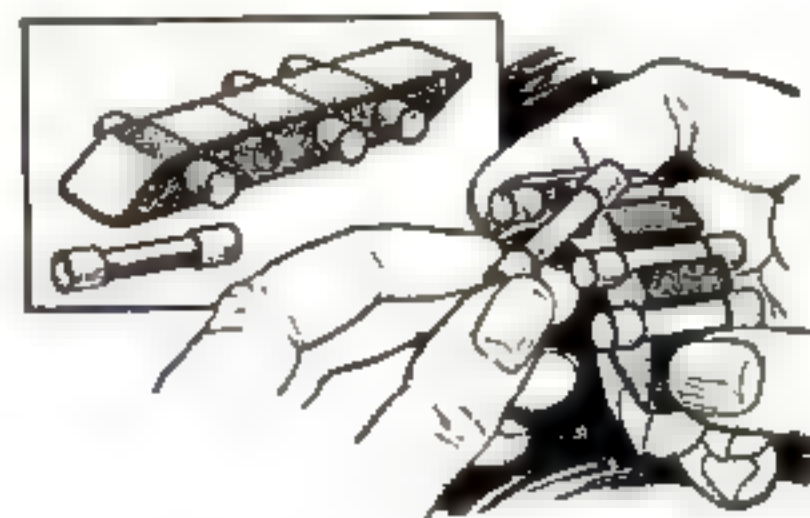
YOU can straighten bent radiator-grille rods neatly with the homemade device pictured above. Two pieces of 1"-by-2" wood about a foot long are fastened together at the ends against $\frac{1}{2}$ " spacers. Hollow out one side of the unit in a curve slightly deeper than that of the undamaged grille. Fit a hook-shaped bolt in the slot with a washer and lever nut as shown. The hook grips the bent rod so that turning the nut pulls the rod back into shape. Each rod must be drawn a little beyond its proper position, which it will take when the device is removed.—A.W.

Car's Gearshift Lever Reveals Motor Troubles

IF YOUR car is of the type that has its motor mounted in rubber, your gearshift lever can be used as a handy indicator of motor troubles. When your motor is idling smoothly, the lever will vibrate evenly. The slightest miss or gallop in the engine, however, will cause it to jump sideways with every other revolution of the motor.—B.E.G.

Eraser Makes Holder for Carrying Spare Fuses

SPARE fuses for your car are always a wise precaution, but they are apt to get broken before you need them. A safe way to carry them is in a five-cent eraser, as shown. Drill holes a little smaller than the diameter of the fuses through the eraser and cut slits through to each hole. The fuses then can be inserted or removed easily, and they are safe from damage until needed for replacements.—R.T.



**SPARK PLUGS
NEED CLEANING
TOO!**

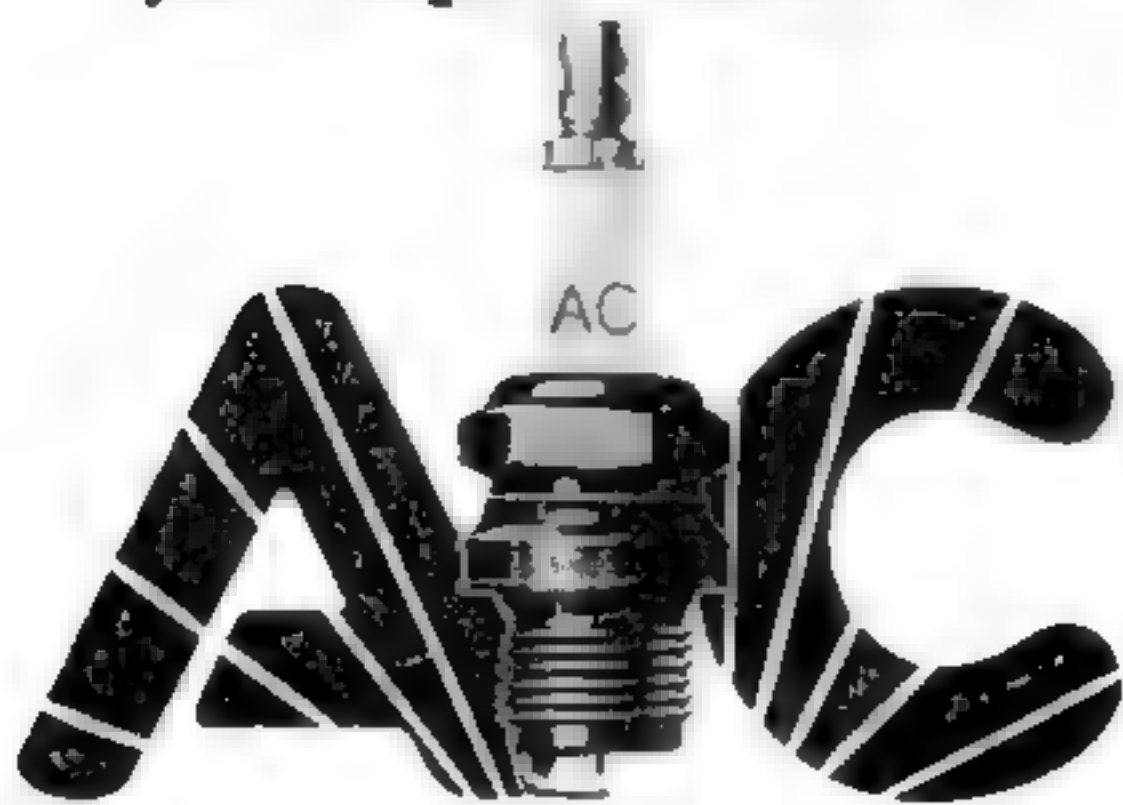


Here's Why

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AC Spark Plugs for every kind of service

AC Quality Spark Plug types are approved by the engineers who design the engines. So, the type specified for your engine is sure to give you complete satisfaction.



The Quality Spark Plug

In 4,000 miles, the lower end of a spark plug becomes heavily crusted with oxide coating, soot, and carbon. When hot, this crust is a good electrical conductor. High engine compression, found in all modern cars, presents stiff resistance to the passage of an electrical spark. Consequently, the current which normally jumps the gap between the spark plug electrodes—thus producing the spark which ignites the fuel—takes any easier way which exists to the "ground." It follows the oxide coating when the spark plug is hot. This condition is aggravated when engine compression is raised—as on hard pulls or at high speeds. Every time that a spark plug fails to fire, the fuel in the combustion chamber is wasted—and engine power lost. This gas waste can be as high as one gallon in ten. The plug cleaning service which more than 70,000 Registered AC Cleaning Stations render is your easiest, *surest*, and cheapest way to prevent this gas waste and power loss. Have your plugs cleaned every 4,000 miles.

LOOK FOR THIS SIGN →
when you want your plugs cleaned



**AC SPARK PLUG DIVISION • General Motors Corporation
FLINT, MICHIGAN**



Ring-Shaped Illuminator

FOR PHOTOGRAPHING SMALL OBJECTS

individual toggle switches could be installed near each lamp if desired. Raising or lowering the reflector changes the angle of the light.

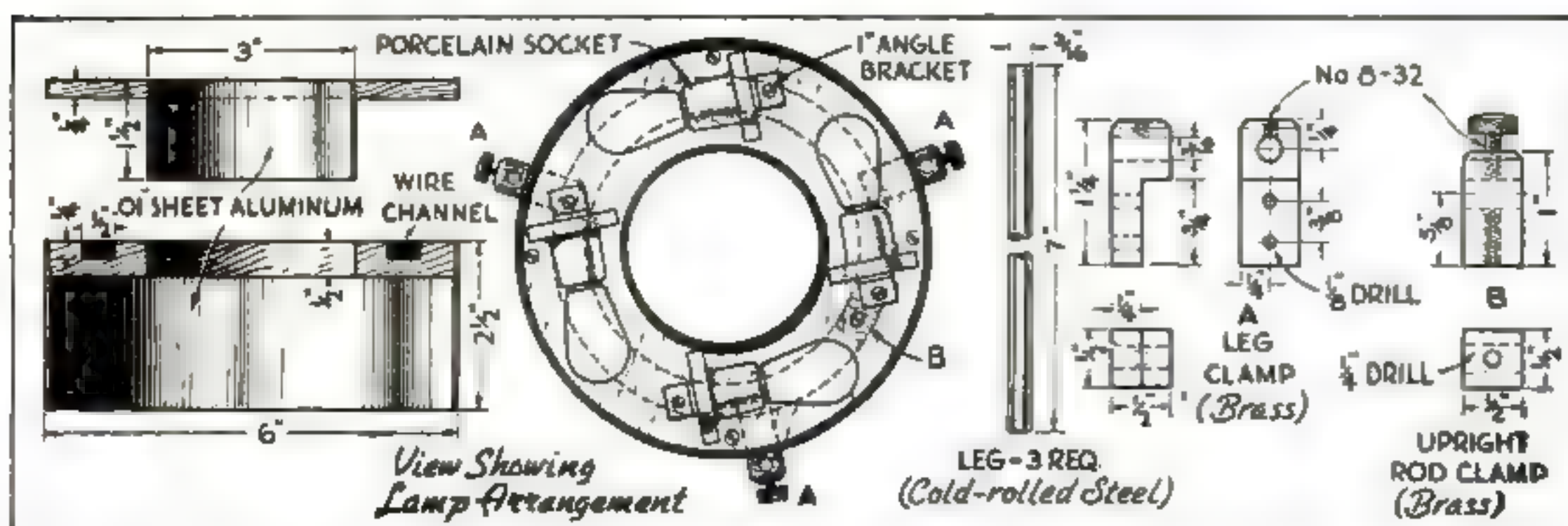
The construction is as illustrated. Where a greater height is required than that provided by the three legs, a clamp, marked *B*, is used for fastening the reflector to an upright post. In this way a small section of a large object can be illuminated.

The porcelain candelabra sockets are held in place by small angle brackets. The lamps are standard S-6 type, 110 volts, 6 watts, clear. With brief time (*Continued on page 232*)

Any type of light effect, including "shadowless," may be obtained with this four-lamp illuminator

FOR photographing small objects to larger than life size (macrophotography), correct lighting, which is of the utmost importance, can be obtained with an illuminator like that shown.

Four lamps are mounted in a ring-shaped reflector, and the camera pointed through the ring at the object below. When all lamps are on, the lighting is what might be termed "shadowless" or without strong shadows. One lamp gives strong side lighting; two opposed lamps, cross lighting, and so on. To turn off the lamps, they are partially unscrewed, but



Top view of opened illuminator showing wire channel. Above, view from the other side to show lamps

Left, the two main parts; an assembly view from beneath; leg, clamp details

3 NEW KODAK FILMS FOR MINIATURE CAMERAS

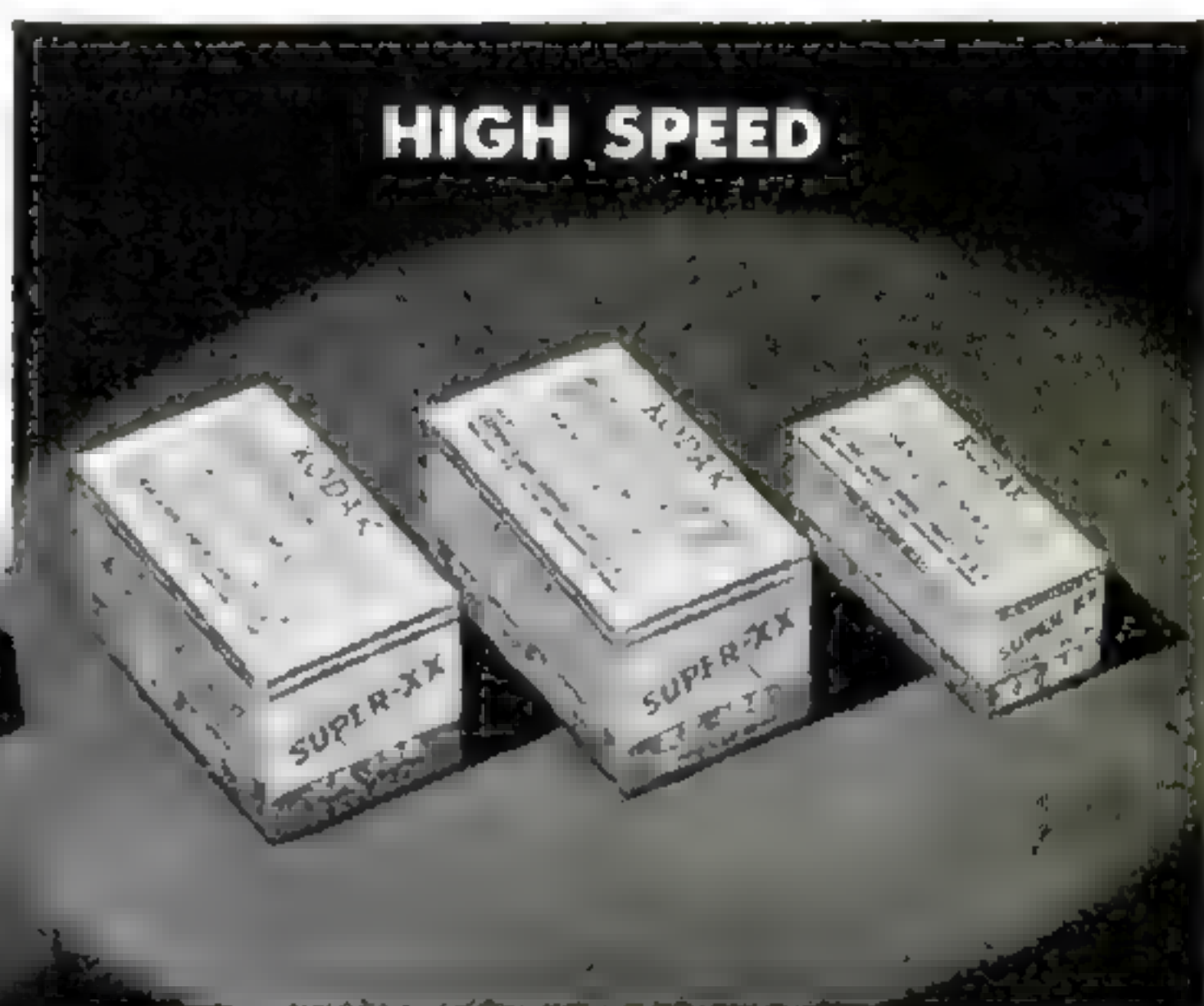


KODAK PLUS-X FILM

About double the speed of Kodak Panatomic, about 50 per cent faster than 35 mm. "SS" Pan—plus finer grain than Panatomic. Now your miniature negates with ease shots that were once beyond its scope. In spite of adverse light conditions, your negatives yield sparkling, richly-detailed enlargements. Kodak Plus-X Film is fully panchromatic with a special blue base to guard against halation and light fog.

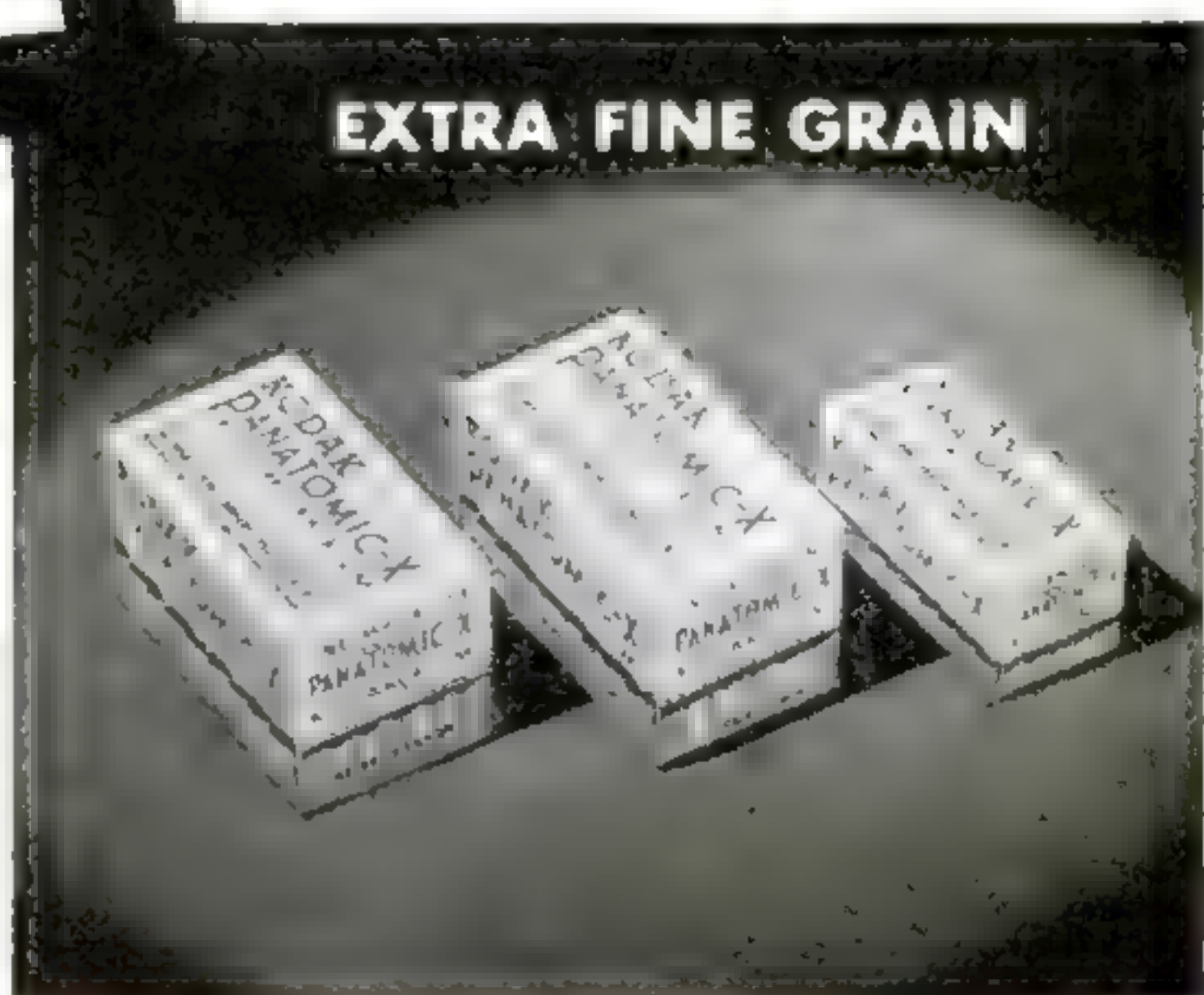
KODAK PANATOMIC-X FILM

Fineness of grain which goes far beyond that of Kodak Panatomic. Your enlargements from miniature-camera negatives, although many times original negative size, will show no appreciable graininess. Startling brilliance and detail will be faithfully retained. And speed remains about the same as Panatomic. Special blue base guards against halation and light fog.



KODAK SUPER-XX FILM

About four times the speed of Kodak Panatomic, more than twice the speed of Kodak Super X. And with the added advantage of exceptionally fine grain. Enables swift miniature-camera lenses to handle fast-action daytime shots at maximum shutter speeds—get amazing indoor pictures under adverse light conditions. The special blue base guards against halation and light fog.



ALL 3 FILMS NOW AVAILABLE IN 18- AND 36-EXPOSURE MAGAZINES FOR 35 MM. CAMERAS AND IN 8-EXPOSURE NO. 828 ROLLS FOR KODAK BANTAMS... EASTMAN KODAK COMPANY, ROCHESTER, N. Y.

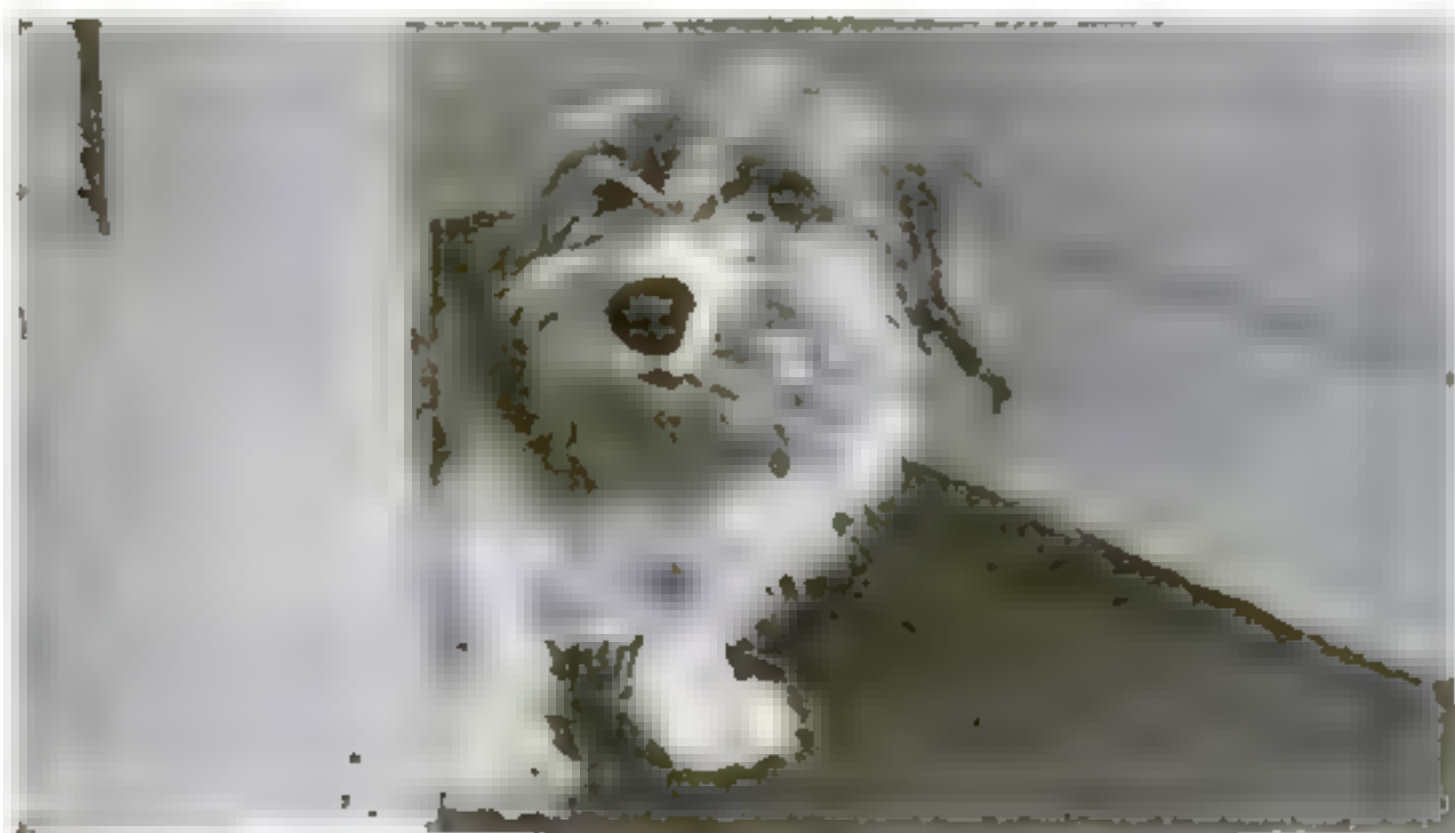
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1. Plenty of light . . . like having a private sun for picture-taking. Three No. 2 G-E Photofloods and supersensitive film get snapshots indoors, even with a box camera.

2. Brighter, whiter light of G-E MAZDA Photo lamps works with today's film to give you clear, better pictures.



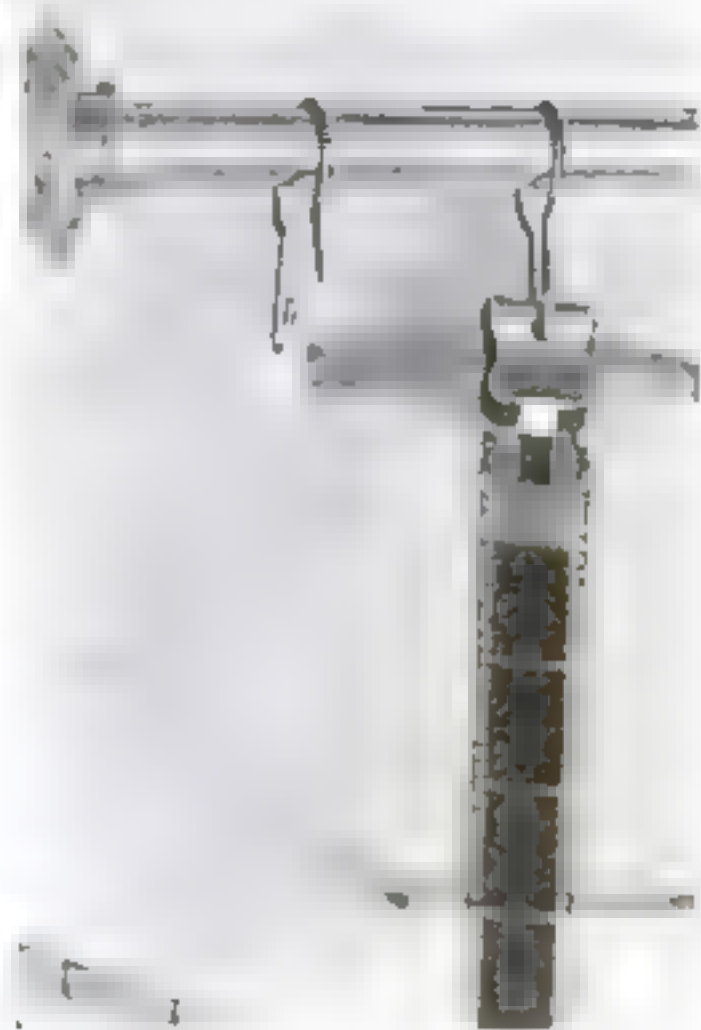
3. Dozens of shots like these . . . with G-E MAZDA Photoflood lamps; three times as many with the No. 2 as the No. 1. Get them at your drug or camera store. For clearer snapshots and home movies, insist on photo lamps marked G-E.



FOR ACTION
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Photoflood lamps.
Each bulb gets
one vivid picture.
No. 10 . . . 15c list.

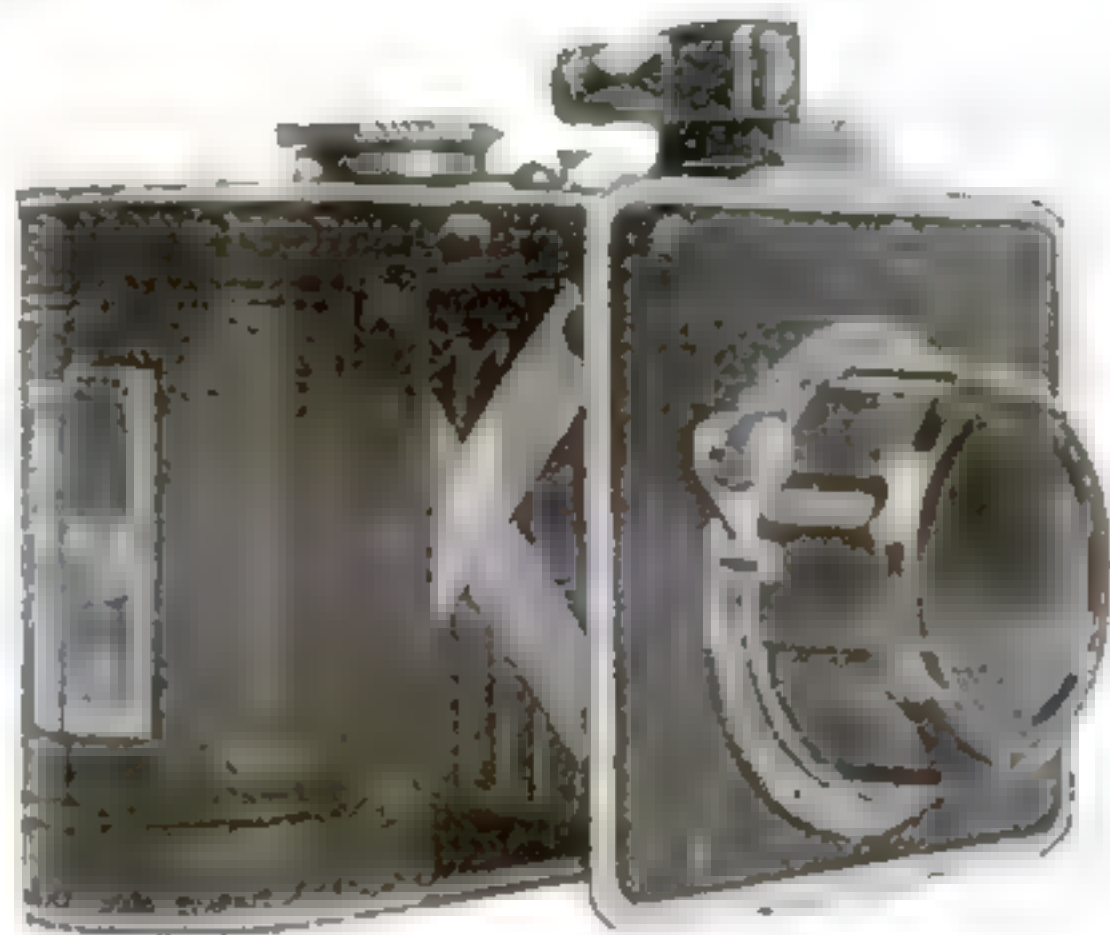


Shower-Curtain Hooks Hold Films While Drying



AS BATHROOMS are comparatively free of dust, they provide an ideal place for drying films. Negative clamps similar to the one illustrated will fit perfectly in the shower curtain hooks. An additional clamp should be used at the bottom of each roll film to prevent curling.—**JOSEPH A. KLOSTER.**

Neat, Durable Lens Cover Made from Bottle Cap



A LENS cover for a small camera can be made from a hard-rubber or composition cap from a bottle. Select a cap slightly larger than the lens barrel and line it with moleskin to protect the lens. To insure a firm fit, an extra strip of the moleskin may be run across the bottom of the bottle cap and up the sides.—**SIDNEY R. BAYNE.**

Ring-Shaped Illuminator

(Continued from page 230)

exposures, they give well-exposed negatives on fine-grain or supersensitive panchromatic film. Be sure to use well-dried wood for the rings and fasten them so that the grains run at right angles in order that no warping will take place later.

The outside of the illuminator is given a coat or two of dull black paint or lacquer, and the reflecting surfaces are coated with aluminum paint.—**A. H. HONEST.**



Rack for Retouching Tools

THE pencils, knife, brushes, and other tools used in retouching photographic negatives or spotting prints and enlargements may be held conveniently in a discarded pipe rack of the type illustrated.—R. DEWITT MILLER.

Holding Half-Size Films in Cut-Film Sheaths



PHOTOGRAPHERS who own cameras of the larger sizes may economize by using film of a smaller size if the film sheath is indented as shown to keep the smaller film from slipping out of place. The ground glass and view finder are then marked to coincide with the film location. The film is sprung into the sheath, rather than slid in as usual. A 4" by 6" camera, used in this manner with the film cut in half, provides a 3" by 4" negative. A 9 by 12-cm. camera may be adapted to take stock-size 6.5 by 9-cm. film. Since film sheaths are low priced, it is feasible to have two sets, the extra set being adapted in this manner to smaller sizes.—R.O.L.



ARGUS Model A
—5 inches long—
weight only 14
oz.—fast f:4.5 tri-
ple Anastigmat
color-corrected
lens; 1/25 to
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ter speeds; 2-po-
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Clear enlarge-
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Your HOBBY

FOR A LIFETIME OF PROFIT and FUN

WITH LOW-COST argus SPEED CAMERA

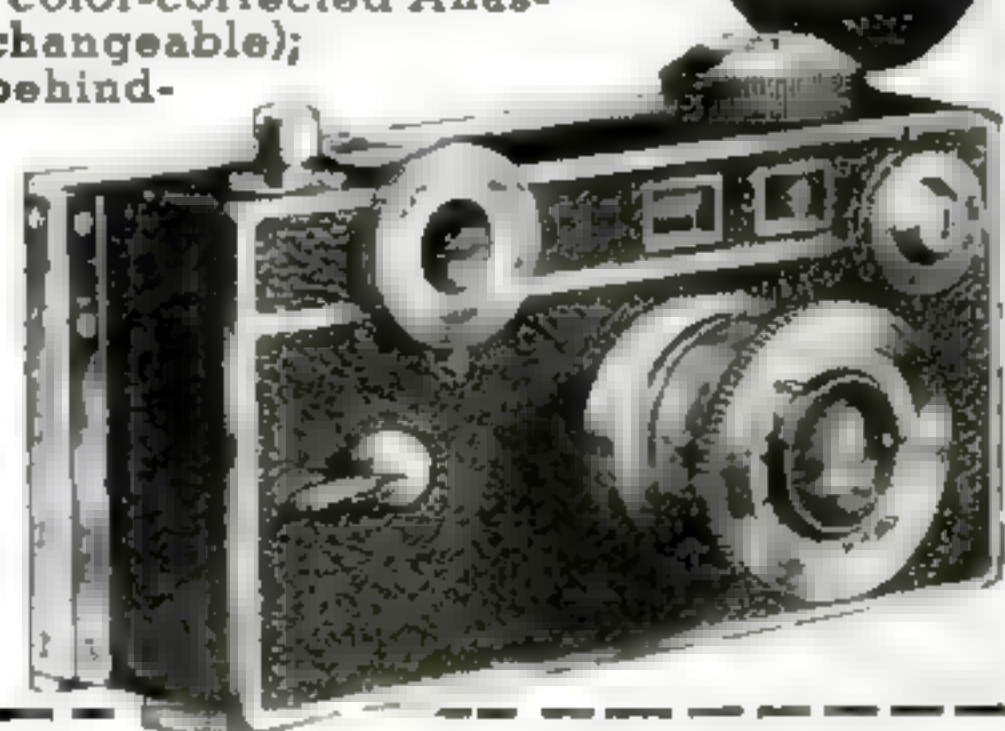
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Acetic Acid Prolongs Life of Old Fixing Bath

WHEN a photographic fixing bath commences to lose its acidity, it can be made to serve longer in an emergency by adding a few drops of acetic acid each time it is used. This expedient is particularly useful when there is no space or facilities for using a separate acid short-stop bath.—K.M.



Pendulum Marks Seconds for Time Exposures



FOR time exposures, an accurate way to count seconds is with the aid of a pendulum made by hanging a small weight by a string from the tripod. Cut the string by experiment just long enough so that one second is required for the weight to complete a swing back and forth.

Eraser on Stirring Rod Crushes Chemicals

A PENNY eraser of the type that slips over the end of a pencil will aid in crushing photographic chemicals and other chemicals if placed on the end of a piece of glass tubing as shown. Since erasers of this kind may be obtained in assorted colors, it is easy to identify stirring rods for use in different solutions.



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On this mammoth charging floor, 25,000 Delco batteries are charged at one time.

Just before shipment, all three cells of each battery are checked for voltage and re-checked for gravity.

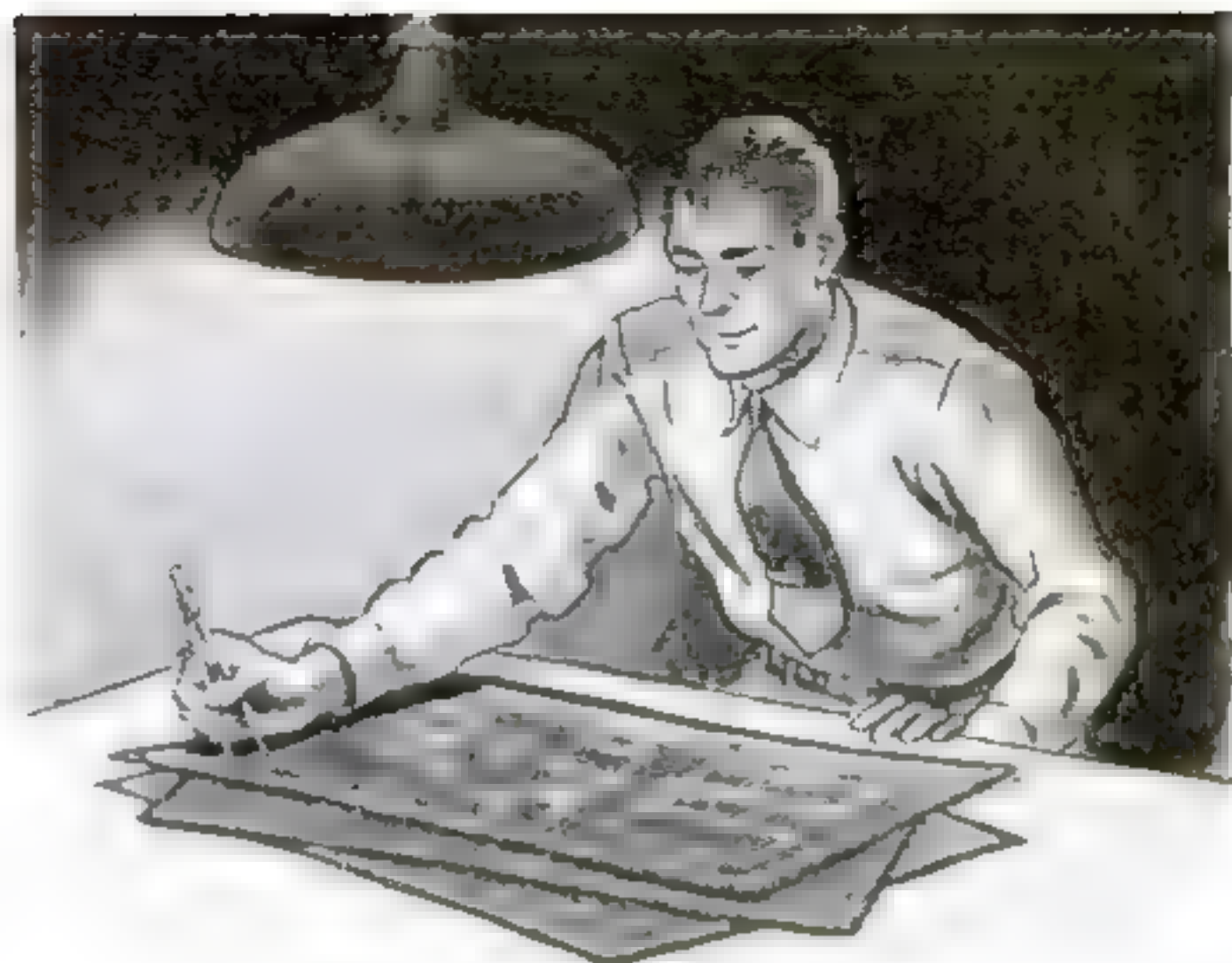
If you were to follow a Delco battery through its various steps of manufacture in one of the Delco-Remy battery plants, you would finally come to the mammoth charging floor. Here, thousands of batteries will be receiving a 48-hour charge before being shipped. From the charging floor, each Delco battery must pass through a final inspection test to determine that it is fully charged and functioning properly. Each cell of each battery is tested separately, as any imperfections in material or workmanship will show in a lowered voltage in the defective cell. Even a minute variation in cell voltage is sufficient to prevent the battery from being passed. This is the final factory test to assure the uniform high quality of Delco batteries.



Delco battery sales and service requirements are available at United Motors Service Stations and Delco battery dealers everywhere.

Delco-Remy
 ANDERSON, INDIANA

World's Largest Manufacturer of Automotive Electrical Equipment



BLUEPRINTS for Making CHRISTMAS PRESENTS

BEGIN now to plan those Christmas presents you intend to make yourself. To assist you, POPULAR SCIENCE MONTHLY offers blueprints for making a wide variety of projects, including attractive pieces of furniture, beautiful ship and coach models, toys, radio sets, and miscellaneous items. Some suggestions are given below. If you do not see what you want, send a stamped, self-addressed envelope for our complete list.



BOATS

Combination Boat, 15' long, for sail, outboard motor, or oars, 131-132-133-R	1.00
Folding Duck Boat, 13' long, 170-R.....	.50
High-Speed Boat for Small Outboard Motors, 7'11" long, 257-R.....	.50
Midget Boat or Pram, 9' long, for oars, sail, or outboard motor, 339-R.....	.50
Motorboat-Rowboat, 16' long, with decked hull, for use with outboard or inboard drives and oars, 149-R .....	.50
Sectional Rowboat, 9' 8" long; can be used with small outboard, 340-341-R.....	.75
Utility Rowboat, 13' long; can also be sailed or driven by outboard motor, 224-R.....	.50



FURNITURE

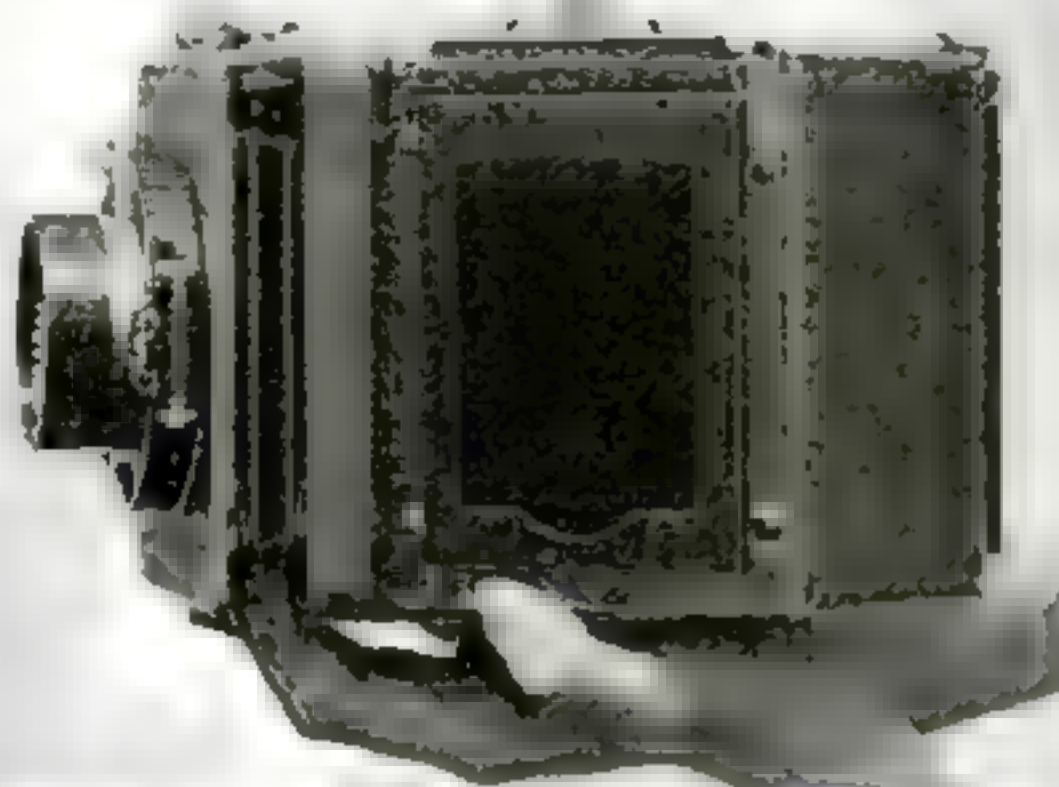
Colonial Writing Desk, Governor Winthrop style, 3'6" high and 3'8" long, 21 .....	.25
Combination Bench and Tilt-Top Table, (no turning), 11.....	.25
End Table, American Empire, 241A.....	.25
Flower Stand (38½" high) and Novel Modern Lamp, 317A.....	.25
Gate-Leg Table, 3'6" diameter, circular top with leaves up (no turning), 24.....	.25
Kitchen Table Cabinet, 27" by 48" top, has folding seat (no turning), 27 .....	.25
Magazine Rack and Wooden Wastebasket to Match, 296A.....	.25
Modernistic Stand (24¾" high) and Bookcase (70½" high), 88.....	.25
Sewing Cabinet of 1812, 178A.....	.50
Small Early Colonial Pine Chest, 32" long, 21" deep, 24" high, 308A.....	.25

(Continued on page 238)

COLOR PHOTOGRAPHS

ON
PAPER

FOR THE
Amateur



12 AMAZING FEATURES OF THE LEROCHROME CAMERA!

1. PRICED LOW ENOUGH . . . for every amateur to own one.
2. ECONOMICAL ENOUGH . . . to operate. (Costs but 16c per shot.)
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7. CRITICAL ENOUGH . . . to catch all the colors of the rainbow.
8. LIGHT ENOUGH . . . to carry and hold with ease.
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10. SHARP ENOUGH . . . to record all the colors in the wings of a butterfly.
11. REGISTER ENOUGH . . . to enlarge from 2 1/4 x 3 1/4 to 11 x 14 inches.
12. SCOPE ENOUGH . . . for Studios, Fashions, Commercial shots and Travelogues.

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1001
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CATALOG

WHOLESALE RADIO SERVICE CO., INC.
109 SIXTH AVENUE • NEW YORK, N. Y.

NOVEMBER, 1938

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2 1/4 x 3 1/4 Size



ALTHOUGH 36% smaller than the next larger Speed Graphic camera size, this brand new 2 1/4 x 3 1/4 camera has Speed Graphic versatility *plus*. Look at these advanced features: interchangeable lenses; double extension bellows; 24 focal plane shutter speeds; built-in photoflash synchronization; rising and falling front; dual finders; dual focusing pinions; helical racks; all metal bed; ground glass focusing; satin chrome trim. A "natural" for close-ups, action shots, scenics, pictorial studies and all-around finer "snap-shooting" night or day. Other Speed Graphic sizes: 3 1/4 x 4 1/4, 4 x 5 and 5 x 7.

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DEPT. PS-19, ROCHESTER, N. Y., U. S. A.

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of fine old
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of pure maple
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*Velvet packs easy in a pipe
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WAXES CARS IN HALF THE TIME
IT CLEANS AS IT WAXES



Who says automobile waxing is a tough job? Not the man who has tried the new Du Pont Speedy Wax (liquid). He knows it waxes cars

in half the time, because it cuts out the preliminary cleaning operation. Speedy Wax cleans as it waxes! And it gives beauty and protection to your car finish! It's easy! And it's quick!

SAMPLE FOR YOU. Send 6c for postage, and get a sample can of Speedy Wax—enough for fenders and hood. (Offer good in U. S. only.) Write Du Pont, Dept. PS-6, Wilmington, Delaware.



Made by Du Pont, makers of No. 7 Duco Polish

Du Pont No. 7 Polish, the world's most popular auto polish, has now been made even better. Works faster and easier. Try it!



Always ask for
DU PONT POLISH

Plans for Making Presents

(Continued from page 236)

Tavern Table and Scroll Mirror, 105.....	.25
Telephone Table and Stool, 18 .....	.25
Tilt-Top Table, 20" by 24" top, 249A.....	.25
Upholstered Stool, 240A.....	.25



MISCELLANEOUS

Automatic Lighthouse Night Lamp and Pelican Design Sewing Kit, 255A.....	.25
Bird and Animal Patterns, 56.....	.25
Electric Train, Horse, and Doll House, 14 .....	.25
Four-Treadle Hand Loom, 268A-269A.....	.75
Nautical Porch Lamp and Hanging Wall Cabinet, 280A .....	.25
Paddle-Wheel Magazine Rack, Ski Repairs, and Rack for Table-Tennis Paddles and Balls, 343A....	.25
Perpetual Star Chart, 214.....	.25
Six Simple Block Puzzles, 65.....	.25
Toy Lathe, Drill Press, Saw, and Jointer, 113.....	.25
Turned and Inlaid Buffet Set (bowl and pair of candlesticks), 307A.....	.25
Wood Mosaic Serving Tray and Novelty Wooden Book Ends, 297A.....	.25



MODELS

Brig MALEK ADHEL, 20" hull, frame-and-plank or solid-hull construction, 304-305-306-R	1.25
Clipper Ship in a Bottle, 121-122.....	.50
Clipper Ship SOVEREIGN OF THE SEAS, 20 1/2" hull, 51-52-53-R.....	1.00
Cody Coach, 13" long, 144-145-146-R.....	1.00
CONSTITUTION ("Old Ironsides"), 21" hull, 57-58-59-R	1.00
Farragut's Flagship HARTFORD, 33 1/2" hull, 221-222-R	1.50
MAYFLOWER, 24" long, 83-84-85-R.....	1.00
Miniature Coach and Covered Wagon, for decorating boxes, 202-R.....	.50
New Bedford Whaleboat, with complete equipment, 14" long, 326-R.....	.50
Old Naval Gun, a six-pounder in battery; gun is 7 3/4" long; 9" by 11 1/2" overall, 352.....	.25
Privateer SWALLOW, a Baltimore Clipper, 13" hull, 228-229-230-R.....	1.00
Racing Yacht, 20" Marconi-rigged sailing model, 48-R .....	.50
Show Boat, Mississippi River type, 14" long, 263....	.25
Trading Schooner, 17 1/2" hull, 252-253.....	.50
U. S. Battleship TEXAS, 3' hull, 197-198-199-200....	1.00
Viking Ship, 20 1/2" long, 61-62-R .....	.75

[Construction kits are available for some of these models. Turn to page 240.]



RADIO

Amateur Continuous Wave Transmitter, two tubes, either 171A, 245, or 210. Blueprints Nos. 183-184 .....	.50
Amplifier, Three Stage, 42 .....	.25
Five Tube Short-Wave Set, midget receiver with loudspeaker, A.C. or D.C., 223 .....	.25
One-Tube Receiver, battery operated, 103.....	.25
Screen Grid Receiver, 109.....	.25
Short Wave Converter, 137.....	.25

POPULAR SCIENCE MONTHLY

353 FOURTH AVENUE, NEW YORK

Send me the blueprint, or blueprints, numbered as follows:

I am inclosing..... dollars..... cents

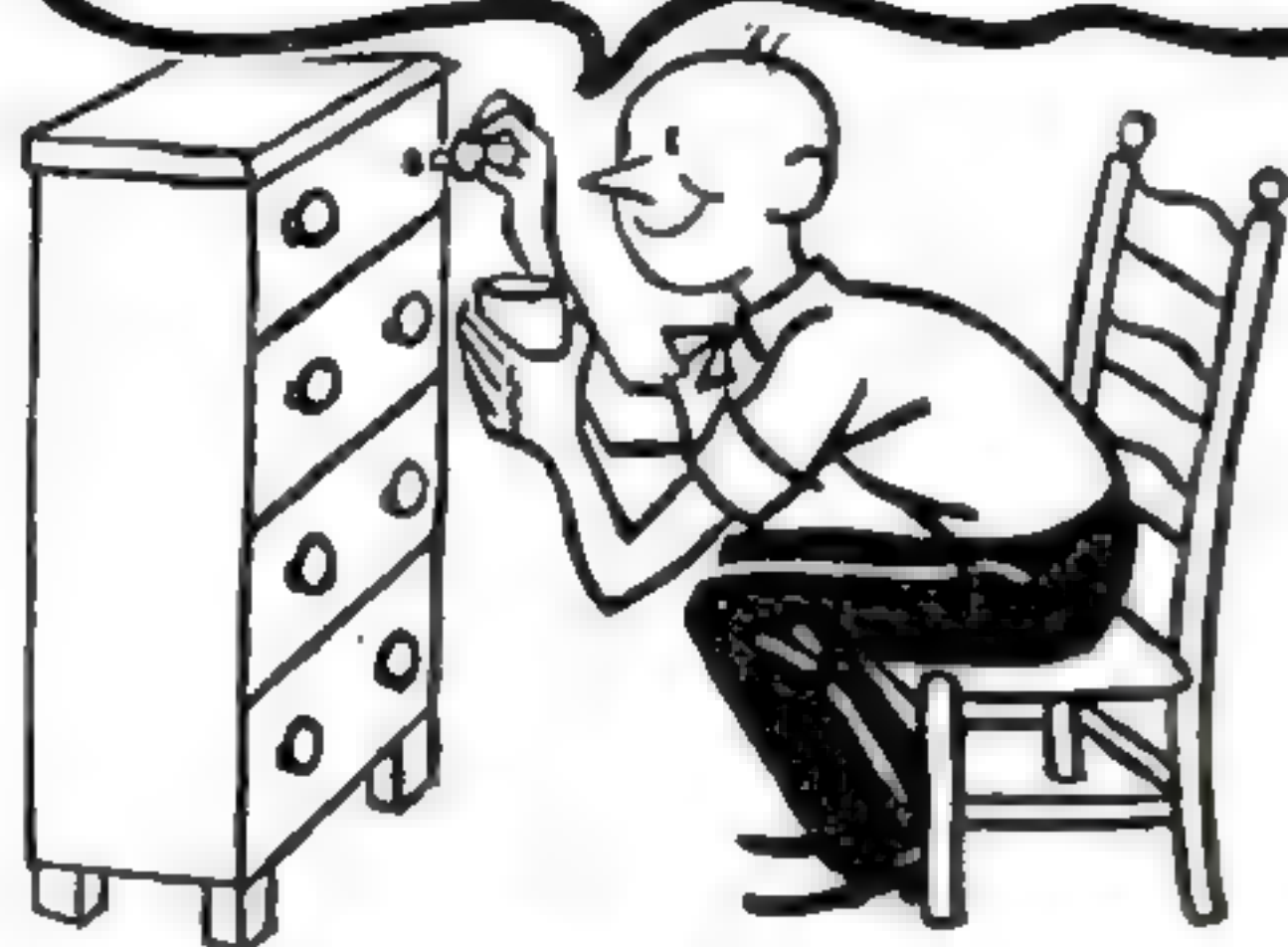
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THIS CANNED WOOD MAKES ALL HOME REPAIRS EASY

broken chairs holes in floor loose drawer pulls
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With Plastic Wood—the discovery that handles easy as putty and quickly hardens into lasting wood—it's easy to do an expert job of repairing. You can paint it, carve it—holds nails, screws. Sold at paint, hardware, 10¢ stores in 10¢ & 25¢ tubes, and 35¢ cans.



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Quickly, permanently joins and repairs china, glass, wood, celluloid, etc. It's Transparent—yet sets like granite.

Also available in Metal color. At paint, hardware, 10¢ stores.



**Old English
CEMENT**



Kit V is for making this clipper model

NOW IS THE TIME TO START Building a Ship Model for Christmas

SHIP models make excellent Christmas presents, so why not start now to build at least one to give away when the holiday arrives? Such a gift is always highly treasured. To simplify the work for you, we have prepared construction kits that contain all the necessary raw materials, together with full-size blueprints and instructions. We also have model railway, furniture, and whittling kits; and a special kit (No. 11) for assembling a marionette of Dopey from "Snow White and the Seven Dwarfs" (see page 160).

MODEL-OF-THE-MONTH KITS

M.	Aircraft carrier SARATOGA, 18" long.....	\$1.00
N.	Convoy of four U.S. destroyers, each 6½" long	.75
R.	U.S. cruiser TUSCALOOSA, 11¾" long.....	1.00
U.	HISPANIOLA of the book and movie "Treasure Island," 7" long	.50
Z.	H.M.S. BOUNTY, 8½" hull, 11½" overall.....	1.50
2M.	Ocean freighter, 14" long	1.50
3M.	Yacht NOURMAHAL, 8½" long.....	1.00
4M.	Oil tanker, 14" long.....	1.50
5M.	Liner PRESIDENT LINCOLN, 14¾" long	1.50
6M.	Fishing Schooner WE'RE HERE of "Captains Courageous," 9½" over all.....	.75

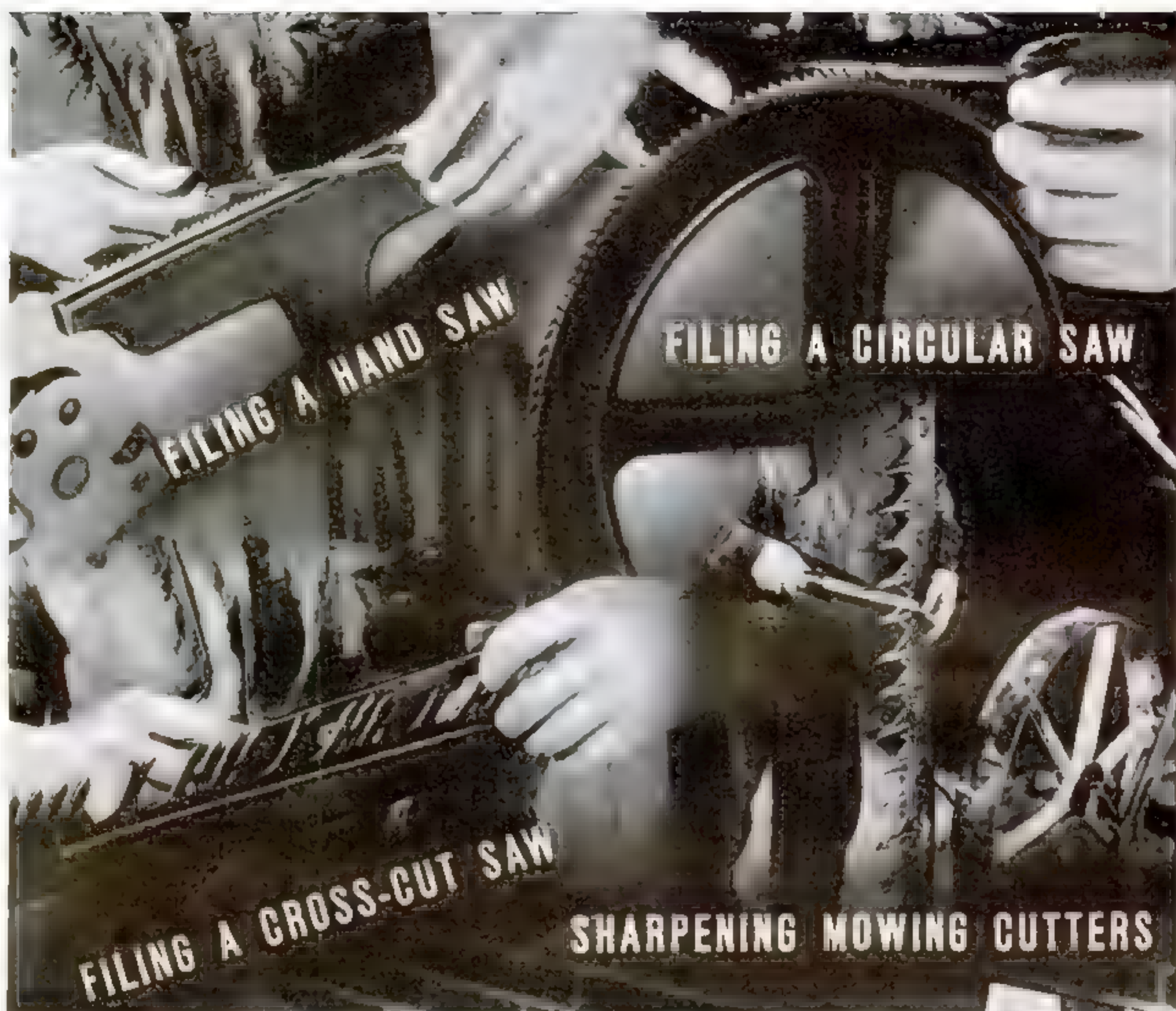
SIMPLIFIED SHIP MODEL KITS

F.	Liner S.S. MANHATTAN, 12" long.....	1.00
H.	Cruiser U.S.S. INDIANAPOLIS, 12" long.....	1.50
J.	Clipper SEA WITCH, 9½" hull, 13" over all.....	1.50

STANDARD SHIP MODEL KITS

A.	Whaling ship WANDERER, 20½" hull, 27" over all.....	7.40*
D.	Spanish galleon, 24" hull, 30" over all.....	6.95*
E.	Battleship U.S.S. TEXAS, 3' long.....	7.45*
G.	Elizabethan galleon REVENGE, 25" hull, 28" over all.....	7.25*
L.	Farragut's flagship HARTFORD, steam-and-sail sloop-of-war, 33½" hull, 41" over all.....	8.45*
Q.	Privateer SWALLOW, a Baltimore clipper, 12½" hull, 20" over all.....	4.95†

(Continued on page 242)



Free NICHOLSON BOOK

Tells How To Do All These Jobs
and Many More! . . .



No wonder that file users everywhere are writing for this book — and receiving it with eager interest! Beginners and veterans alike are finding paragraph after paragraph of valuable hints on how to use files in this book's 28 pages! Its scores of photographs make instructions easy to understand and follow. The popular file types shown and described are of real help in choosing and buying files.

Whether you're a repairman, farmer, home craftsman, carpenter, or

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Nicholson or Black Diamond Mill File — for saw sharpening and all-around finishing work.



NICHOLSON FILES



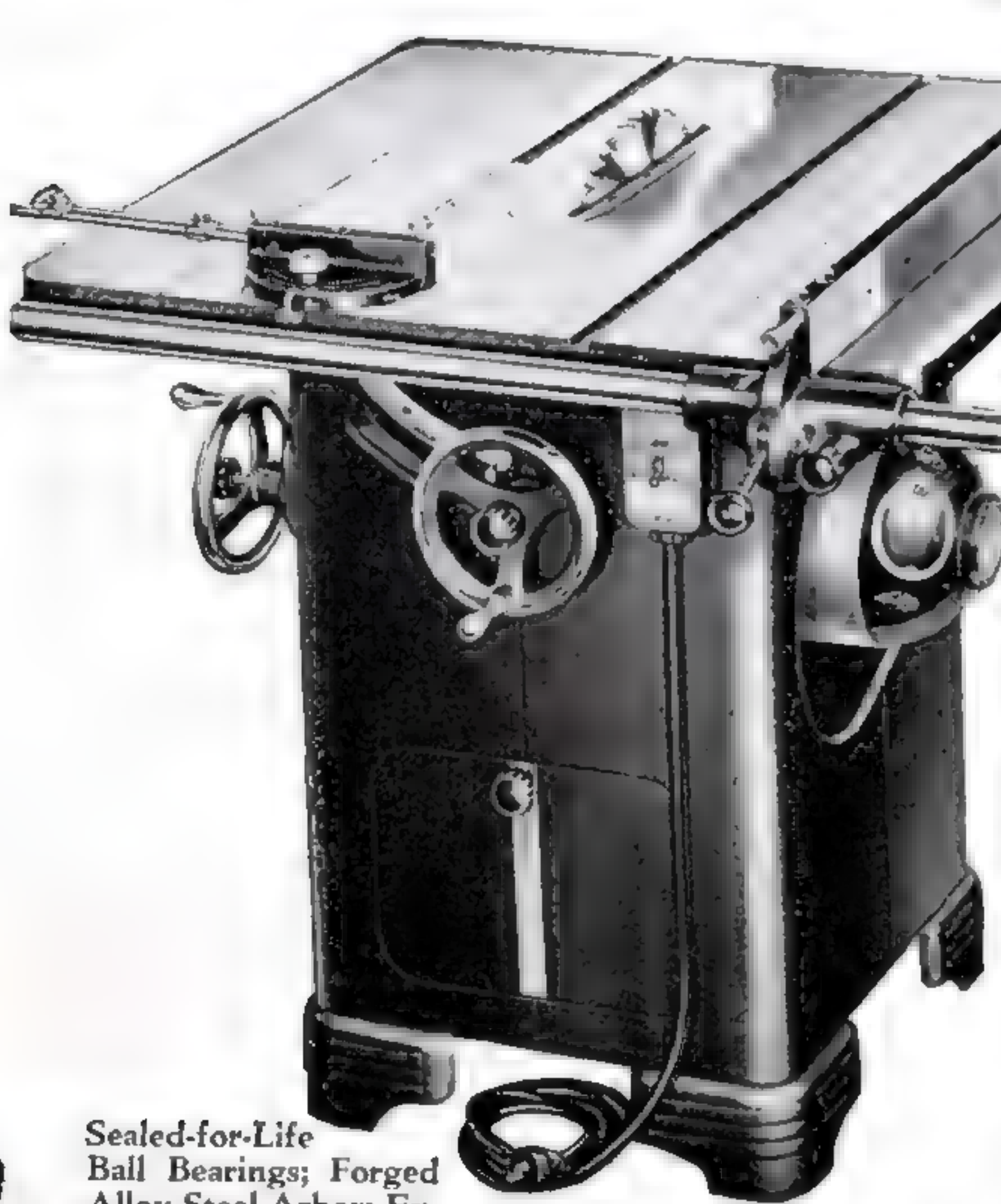
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Send for your copy today—and at the same time receive the new 1939 Delta Catalog illustrating, describing, and listing prices of the complete 1939 line of Delta "Quality" motor-driven tools. Send the coupon TODAY!

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- 2. Highly Efficient "Tex-Rope" Drive**—The famous, efficient drive and trouble-free Allis-Chalmers triple V-Belt adapted for the tilting arbor saw. No gears; no noise; no twisted belts. The most efficient and satisfactory drive obtainable. Costs more than gears—but worth it!
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- 4. New Scientifically Designed Rigid Housing**—Encloses all vital parts; catches practically all saw-dust—modern; rigid; yet not so heavy as to sacrifice portability.
- 5. Patented Double-Face, Double-Lock Rip Gauge**—Extending completely across table and locked rigidly at front and rear. Accurate, non-warping, rigid, safe, and with micrometer adjustment—standard equipment.
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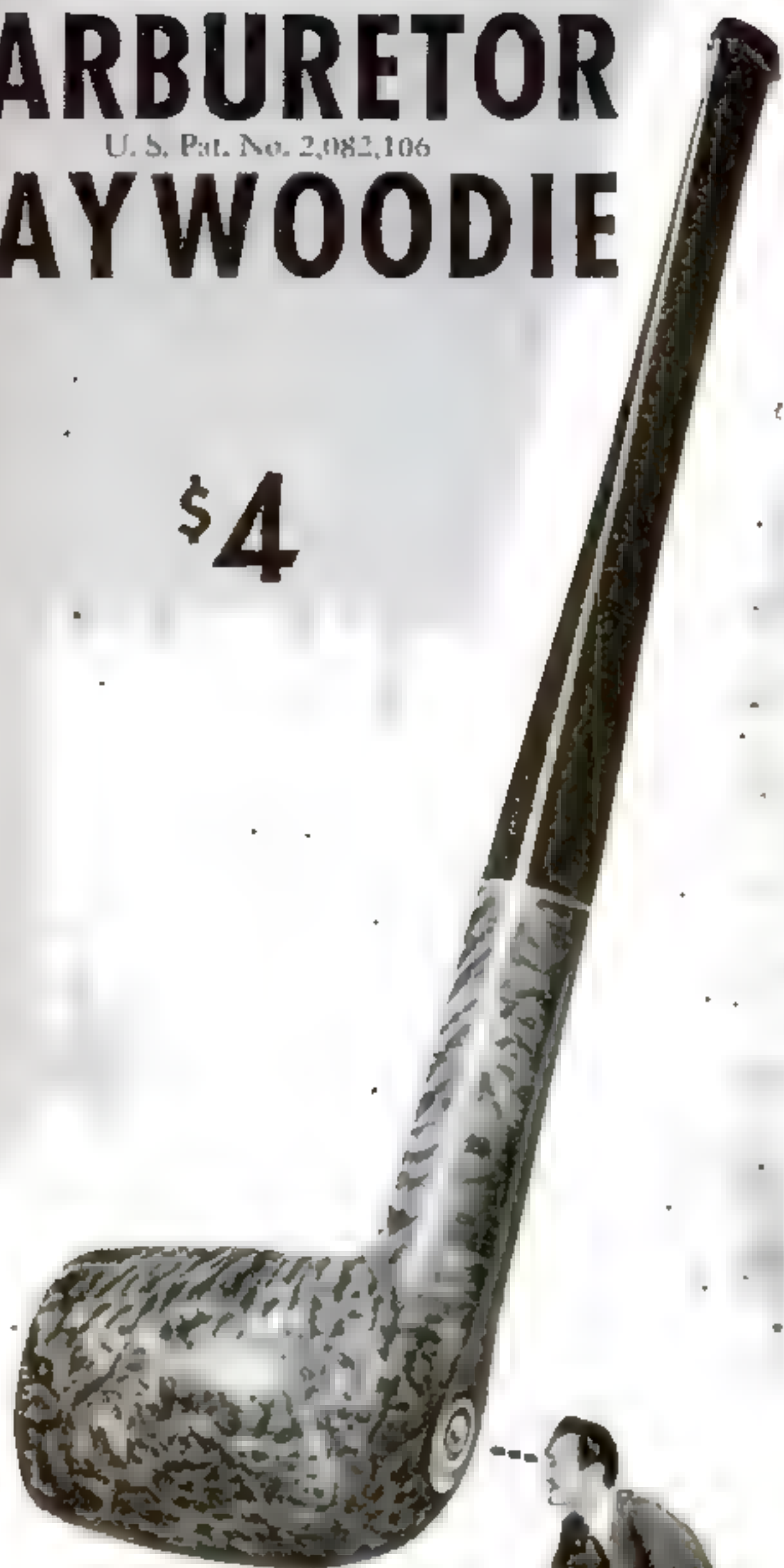
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☐ Check here if you are a Delta user now.

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*Focus your eye
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See that little metal inlet? It's called a *carburetor* because that's just what it acts like. It lets a tiny geyser of air come into the bowl, so the harder you puff away at your pipe, the more air comes in. If you "heat up" your pipe, this keeps it cool all the time. The tobacco burns more evenly, you get a sweeter, drier smoke. Add a Carburetor Kaywoodie to your collection. Drop in at your dealer's, see the Carburetor Kaywoodies, and ask for the Kaywoodie Almanac.

Shape pictured No. 29 (SLIM BILLIARD). (Slightly less than actual size) in "Tobacco Brown," an exclusive Kaywoodie color.

Super Grain \$5, Flame Grain \$10, Meerschaum \$15,
Matched-Grain Sets \$100 to \$1,000.

KAYWOODIE COMPANY
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Kits for Building Models

(Continued from page 240)

- V. Clipper SOVEREIGN OF THE SEAS, 20½" hull, 26" over all..... 4.95†
- Y. Trading schooner, Maine type; 17½" hull, 22½" over all..... 4.90†
- 2S. U.S. Navy destroyer PRESTON, 31½" long 5.95*
- 3S. CONSTITUTION ("Old Ironsides") 21" hull, 31" over all..... 6.50*
- 4S. Clipper ship GREAT REPUBLIC, 31½" hull, 42" over all..... 8.40*
- 5S. Coast Guard Patrol of 165-ft. type, 20¾" long (same as President's yacht POTOMAC)..... 4.95*
- 6S. Brig MALEK ADHEL, 20" hull, 33" over all; frame-and-plank construction 9.75†
- 8S. Fishing schooner BLUENOSE, 17½" hull, 22" over all 4.95†
- 9S. New Bedford whaleboat, with complete equipment, 14" long..... 2.75†



Kit 10S—Confederate raider "Alabama"

- 10S. Confederate raider ALABAMA; steam sloop, bark rigged; 21½" hull, 28" over all..... 8.20*

MODEL RAILWAY KITS

- 1L. HO-gauge, Hudson-type model locomotive and tender, 14" long..... 9.95*
- 2L. Supplementary power unit for locomotive 1L; consists of 6-volt motor and worm and gear 4.50
- 3L. HO-gauge track kit. Contains raw materials for making 25 ft. of track..... 4.00*
- 4L. Deluxe track kit. Same as 3L except that kit contains third-rail chairs..... 6.95*

MISCELLANEOUS

- 4. Solid mahogany book trough 5.30*
- 5. Solid rock maple hanging wall rack 5.75*
- 7. Whittling kit with two shaped blocks for making sea captain 5½" high..... 1.50
- 8. Whittling kit for six different Scotties; each is 2" by 2¼", sawed to shape..... 1.00
- 10. Copycraft whittling kit for making one of several Hobo Hank novelties. Includes master model 5¾" high..... 1.50
- 11. Marionette kit for making a model of Dopey the Dwarf, 9" high. Hand-painted head and complete parts, ready to assemble..... 2.25†

Note: If you live west of the Mississippi River or in Canada, add 50 cents to prices marked with an asterisk (*) and 25 cents to prices marked with a dagger (†).

Popular Science Monthly, Dept. 118A
353 Fourth Avenue, New York, N. Y.

Please send me C. O. D. Kit.....

I will pay the postman the price shown above plus a few cents postage in full payment. (Canadian orders cannot be sent C. O. D.).

Name.....

Address.....

City.....State.....

(Please print your name and address very clearly)

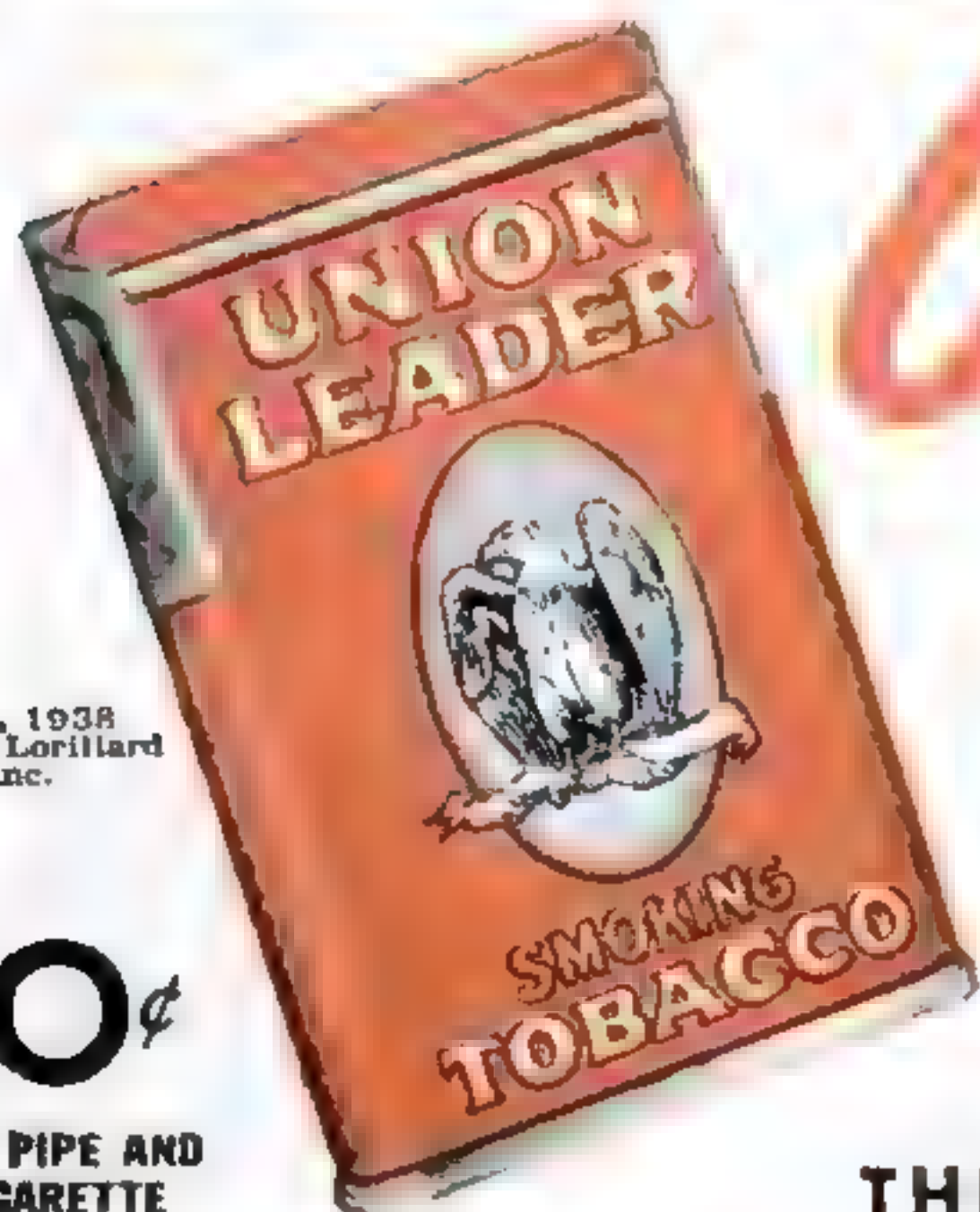
If you prefer to send your remittance with this order, you save the C.O.D. charge. Remit by money order, check, or registered mail. This offer is made only in the United States and Canada. Also see note above.

A perfect blend— A perfect friend

IN 1913. . . . "About the time of this picture I was doin' my darnedest to like pipe smoking but it wasn't until I came across Union Leader, that I found how sweet and mellow a pipe tobacco could be. And Union Leader and me are even better pals today than 25 years ago."



TODAY. . . . "I'm 65 now and looking back at a long life, I can truthfully say Union Leader has done a lot to make the hard times easier and the good times better. I never expect to find kindlier tobacco I like so well at any price, bar none. The cool, even way that Union Leader burns makes it mild as well as rich in flavor."—Mr. E. G. Ross, Newport, Minn.



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Co., Inc.

10¢
FOR PIPE AND
CIGARETTE

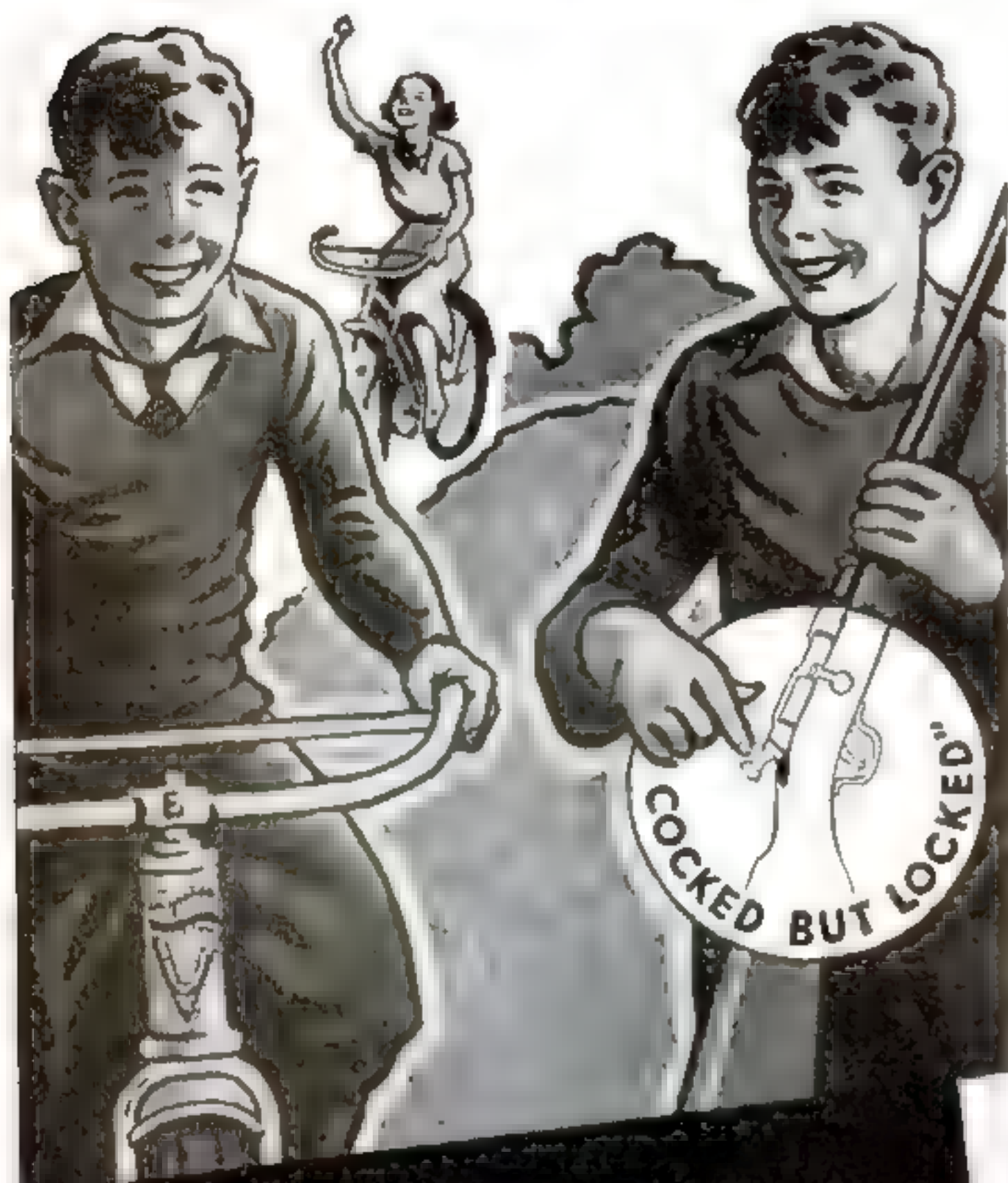
Union Leader

ALWAYS. . . . Day in and day out, for more than a third of a century, UNION LEADER has brought thousands of men deep smoking contentment. This choice hill-grown Burley from Kentucky is aged in oak and specially processed to remove all burn and bite. You'll find it the mellowest, most flavorful tobacco a dime ever bought! Try a tin . . . today!

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OUTDOORS CALLS!

...CALLS FOR A SAFE AND ACCURATE
RIFLE AND A FAST-STEPPING BICYCLE



Iver Johnson

Wintertime is happy gunning time—and here's just the gun for you—a safe, accurate product of expert gunsmithing—the Iver Johnson Self-Cocking .22 Bolt Action Safety Rifle. Patented Automatic Safety and Cocking device make this the fastest shooting rifle made. Price, \$5.75. Send now for Booklet A46.

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Write now for Booklet B46 of complete line.

IVER JOHNSON'S ARMS & CYCLE WORKS

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BOOKLETS ARE FREE—A POSTCARD BRINGS 'EM!



THERE is a considerable saving in lathe work when the bore and the outside diameter can be machined simultaneously. It may require a little time to set up the tool combination, but the method is profitable even with a limited number of pieces.

By shrinking seamless steel tubing on round stock, the cost of many items can be cut in half through savings in material and labor.

To determine a tap-drill size quickly without reference to a handbook table, divide 1.000 by the number of threads and subtract the result from the decimal diameter of the tap. This will give about 77 percent of a full thread.

For small quantity production, blanking dies made from case-hardened, cold-rolled steel cost little and will often serve the purpose well enough.

When you sharpen a long end mill, you needn't be afraid to taper it so it will be 0.002" smaller at the back end because this will compensate for the unavoidable give at the front end.

A two-lip wire drill with an accurately ground point will produce a hole close to reamer accuracy. Try one on your next drilling job, particularly if brass, bronze, aluminum, or copper.

A lathe hand who will use the back gears so as to make a job last longer is the first man to raise a row if the "speed" starts up a minute before schedule.

By doing your own brazing, you can save from twenty to twenty-five percent on your tungsten-carbide tips.

The cost of many large and medium size gears can be substantially reduced by using a less costly grade of steel and resorting to torch hardening.

Taps with ground threads come in three classes. Some are merely finely ground, others are lapped, and the third class is precision lapped. The latter represent the closest approach to perfection and resemble thread gauges in point of accuracy.

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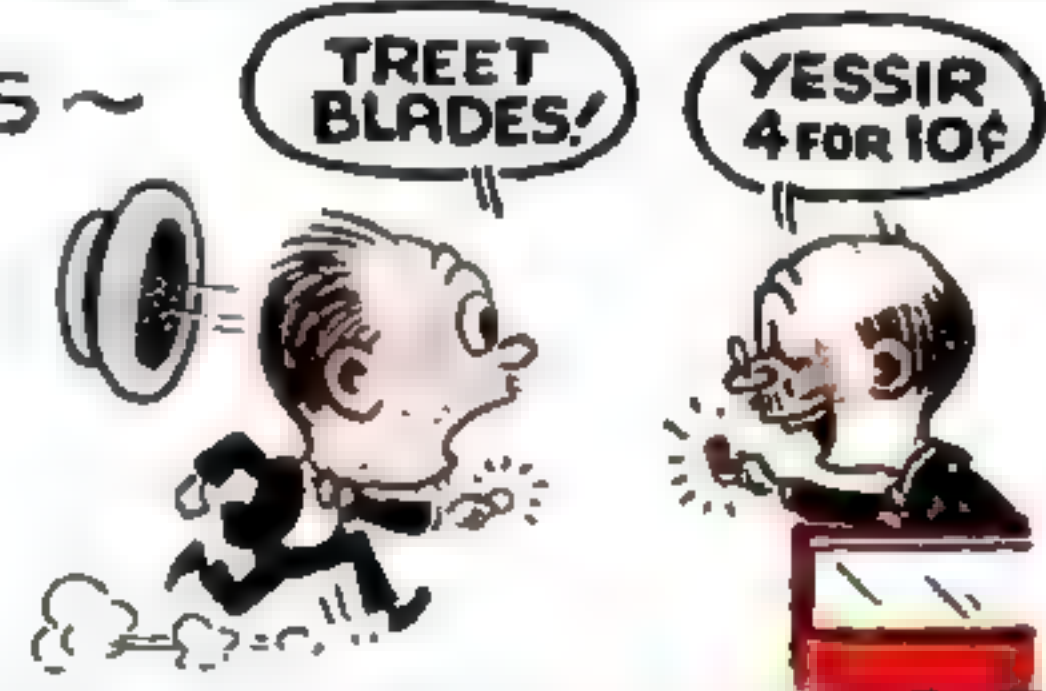
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ABRASIVE

PRODUCTS



Fighting the Dope Rings

(Continued from page 100)

house. Dashing in, I raced through several huge, unlighted rooms and came to a kitchen where two men were eating a fish dinner. I had my revolver in one hand and my badge in the other. One of the men, a hulking long-shoreman built like a bull, leaped at me with a butcher knife. Because I had been in the service only a few months and might be considered too quick on the trigger if I killed a suspect, I was afraid to shoot. So, I dropped my badge and made a grab for a blackjack in my back pocket. Hitting the charging man full in the stomach, I stopped him for a moment. His knife ripped down my sleeve, but missed my arm.

At that moment, the other Federal men arrived. We quieted the prisoners and began searching for the dope. We went through 200 sailors' kits and found no trace of it. We were almost ready to give up when a cat jumped on the table. One of the men shouted at it. It leaped down and darted toward a little cat box, containing sawdust, in one corner. Then it veered away as though afraid of the box. That seemed strange, so I investigated. In a false bottom, beneath the sawdust, I found 700 vials of heroin.

In recent years, the tide of narcotics has been rising with increasing strength. Marijuana is providing a "kindergarten" for dope addicts. In one Ohio town, twenty high-school children were found to be using the dangerous drug. In Illinois, a school-supply store was discovered dispensing "reefers," or marijuana cigarettes, and in Michigan, a woman used her children to peddle them in grade school. From marijuana, addicts go for a "bigger kick" to cocaine and morphine, ending with shattered nerves—mental and physical wrecks.

Marijuana presents a specially difficult problem to law-enforcement agencies. Looking like a harmless weed, the plant can be grown in back yards and vacant lots. Less expensive than other forms of dope, reefers of marijuana are easily disguised as regular cigarettes, and their users are soon enslaved by the degrading habit.

Against sinister gangs that cash in on such human misery, the Government is waging a day-and-night battle. Dope racketeers are the big game of the underworld. Tracking them down is a thrilling and risky job, an occupation that requires cunning and daring combined. Upon the vigilance and integrity of a few hundred men—narcotic agents who take chances of which you rarely hear—the country is depending in its war against illegal drugs.

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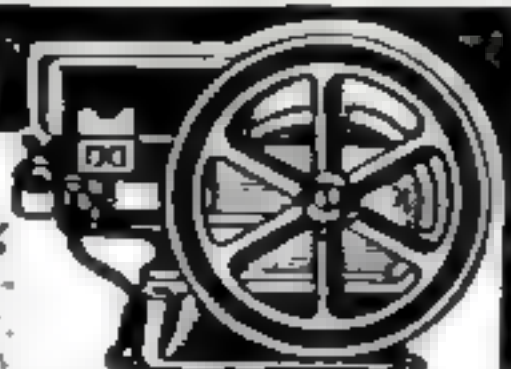


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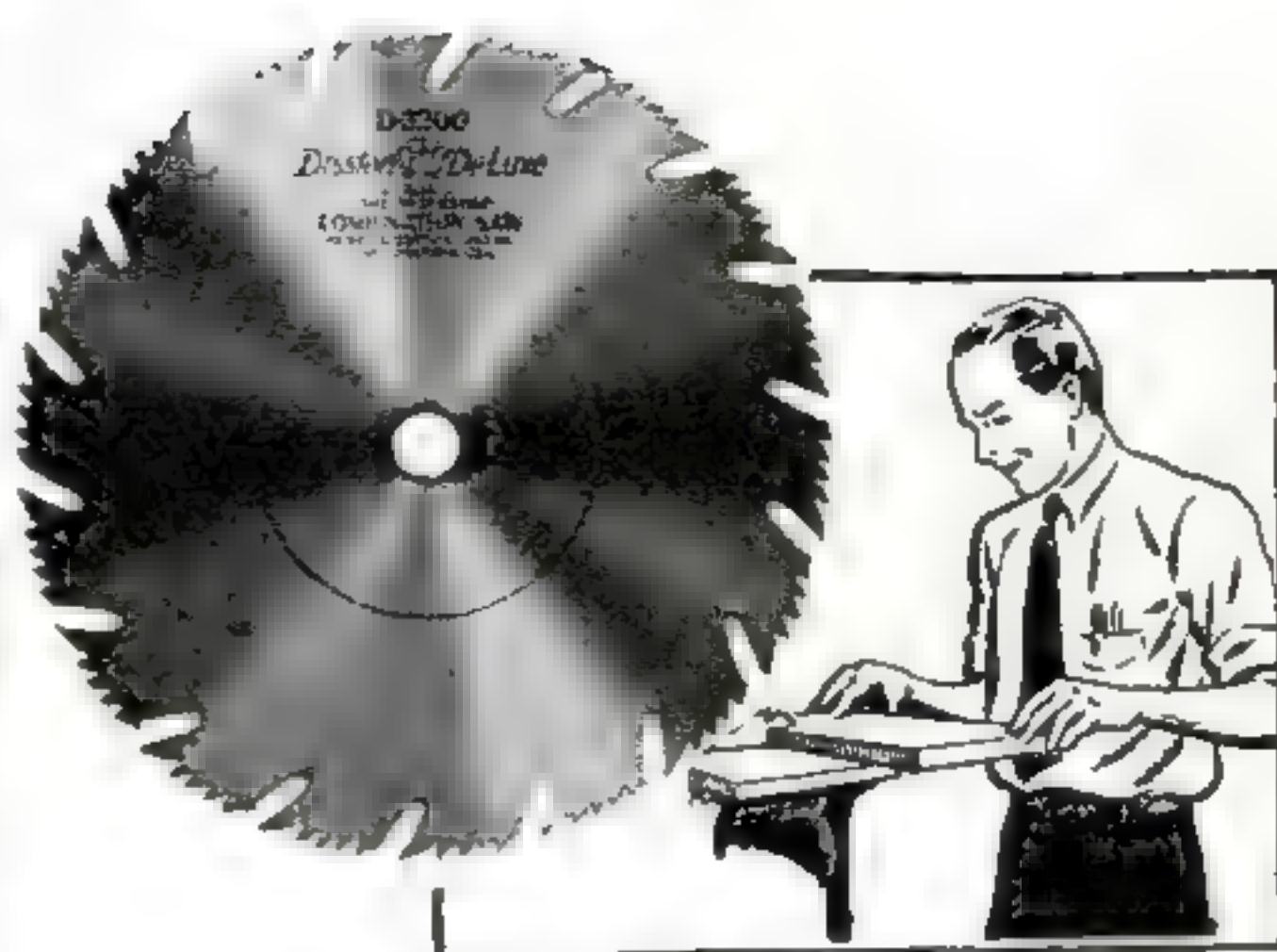
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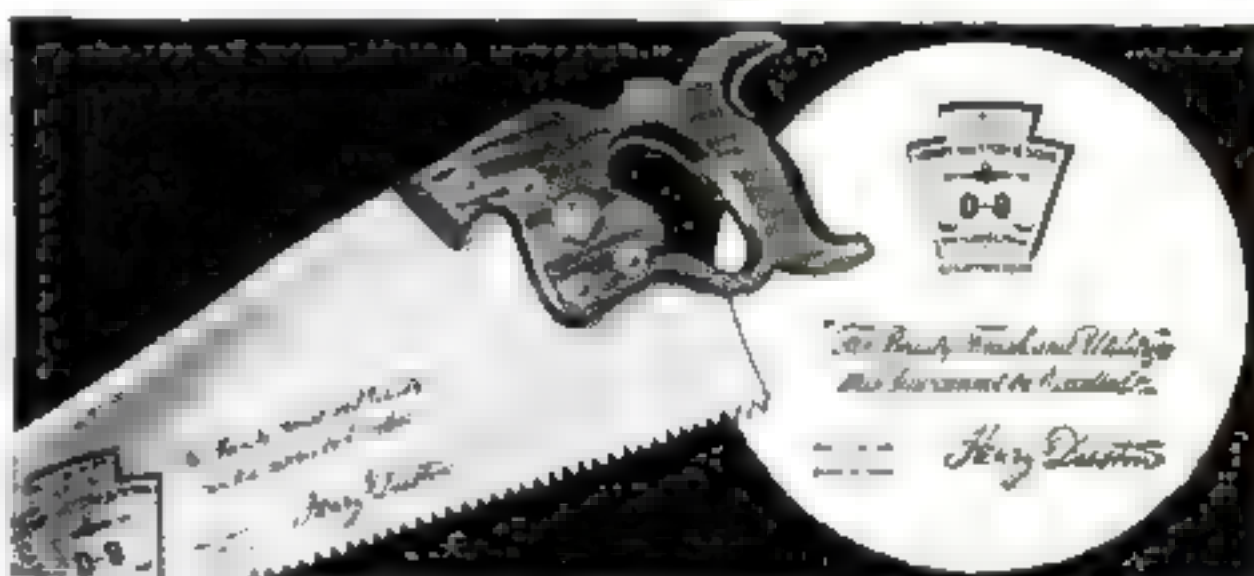
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Queer Troubles with Oil

(Continued from page 158)

cylinders. Then he did the same thing with the master cylinder. After reconnecting the pipes with the cylinders they filled the tank with fresh brake fluid which they pumped slowly through the system to flush it out and to bleed the air out of it. Then Gus replaced the bleeder screws, permitting no air to get into the brake lines, and gave the brake shoes a careful adjustment.

"I'll try her out," he said. After driving around the block once he came in whistling. "That did it," he said. "That spongy feeling of the brake pedal is gone, too—they must have got air as well as oil in the system when they fixed that cylinder."

"I'll admit that you're pretty good—good as a brake-testing machine," Harry told his boss. "Say, Gus—what else can you find out about brakes by just stepping on the brake pedal?"

"Quite a lot," Gus assured him. "If the pedal goes all the way down to the floor boards under moderate pressure, it's usually an indication that the brake linings are badly worn—or, less frequently, that the brake shoes aren't adjusted properly, or that there is either a leak in the hydraulic system, or air in it.

"If brakes squeak when you apply them, it's usually a sign that the brake linings are dirty—that dust has clogged the pores of the asbestos friction lining and caused it to glaze over. You can kill the squeak by cleaning the linings with a stiff wire brush dipped in gasoline.

"The cause of brakes slipping usually is oil or grease that has leaked out of the rear axle and got on the brake linings. Clean the lining and the brake drum by washing them with gasoline, and put on a new washer to stop the leak.

"Sometimes a car will pull to one side when you step on its brakes. A possible cause of that could be that the lining on one wheel is of a different brand from the linings on the other wheels. Different makes of linings have different braking efficiencies, and one lining of low efficiency will make your car slue to one side. Well, it's quitting time. . . . Just learn to use the old bean, Harry, and you'll do all right with brakes or anything else in this business."

While he had been talking, Gus had been making out a time and material slip for the Simpson job. He held it out for Harry to see. "Ran up pretty high for a little job that Jack thought wasn't worth bothering with. But if he'd followed that idea of his of letting it get worse before he did anything about it, it would have cost him a lot more in the end."

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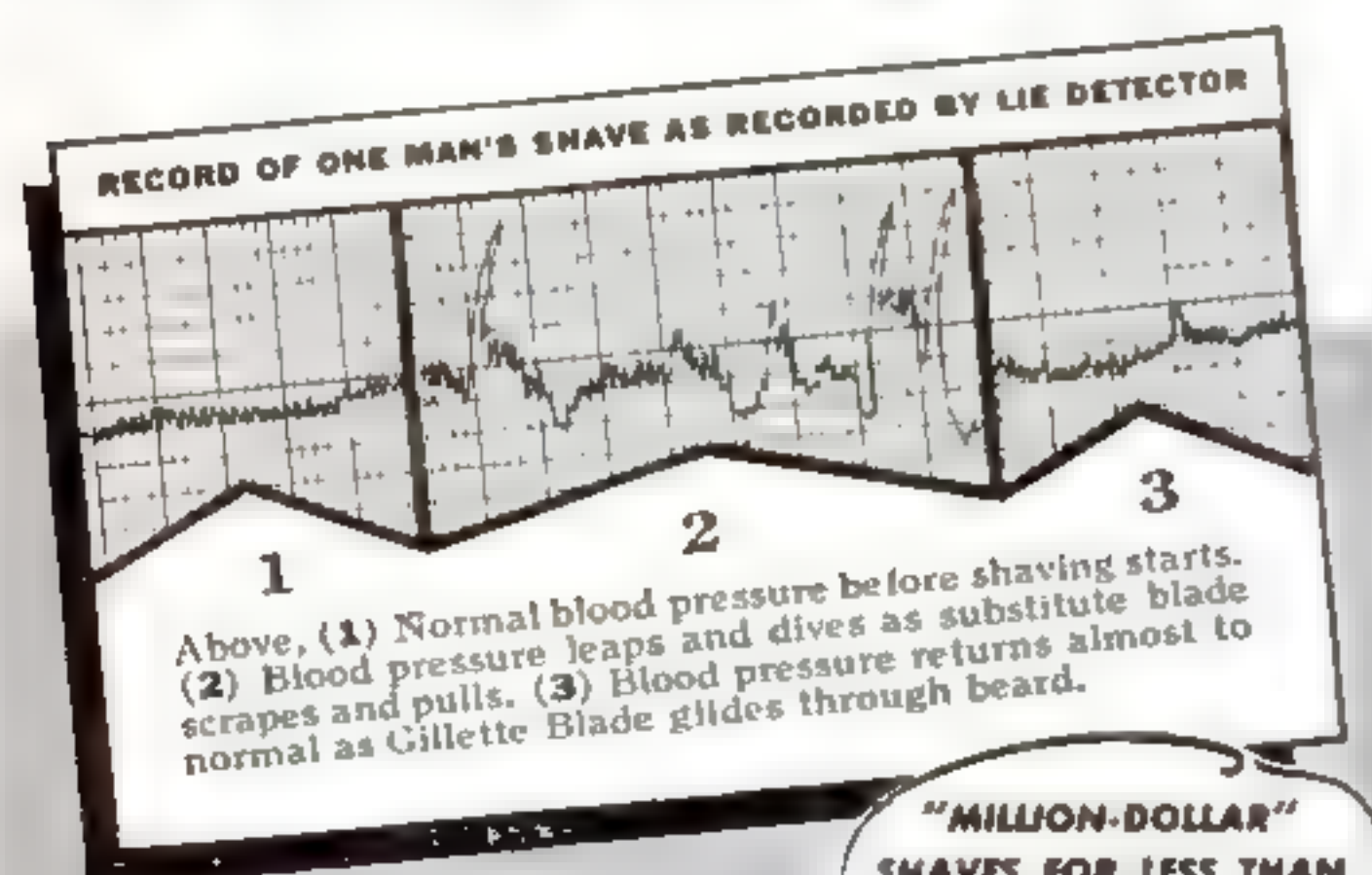
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Home-Laboratory Tests With Alcohol

(Continued from page 219)

cohol, and isopropyl alcohol. These are among the denaturants that have been used to render ethyl alcohol unfit for drinking, in commercial products such as antifreeze alcohol for automobile radiators and rubbing alcohol.

While the experiment of Salernus with the red wine, described at the beginning of this article, may have been intended to astonish the home chemists of his day, it is a fact that he was using a substance which actually has been manufactured by man since the dawn of history. That substance is alcohol, which in one form or another has been extensively used as a beverage from time immemorial. Today, however, it has a broad field of usefulness, and we find that the chemical industry, in many of its phases, is dependent upon a steady supply of methyl and ethyl alcohols.

Oddly, ethyl alcohol still is made by the same process used before Salernus and before anyone else we have a record of. The method is simply the fermentation of starchy or sugary materials.

Fermentation is a chemical action best described as the decomposition set up in a carbohydrate by the presence of certain organic catalysts, the latter known as "enzymes," such as occur in yeast. Carbon dioxide is given off during the fermentation process, and the solution warms slightly.

It once was believed that fermentation was really a biological activity of the living cells of yeast. Chemists then found that certain fluids given off by the cells stimulated the same activity that the yeast itself did, and they thus learned that the fermentation was purely chemical.

POPULAR SCIENCE Question Bee

ANSWERS to the Question Bee on page 152 are listed below. You can find out for yourself what score you made by giving yourself five points for each correct answer. The letter beside each number indicates the correct solution to the corresponding numbered question. A score of 75 to 85 is good, and 90 to 100 is excellent.

- | | | | | |
|------|------|-------|-------|-------|
| 1. d | 5. c | 9. c | 13. b | 17. d |
| 2. d | 6. f | 10. a | 14. b | 18. c |
| 3. c | 7. a | 11. c | 15. c | 19. d |
| 4. a | 8. b | 12. d | 16. d | 20. b |

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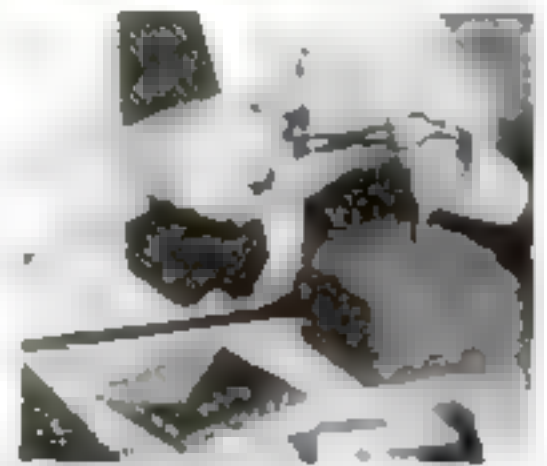
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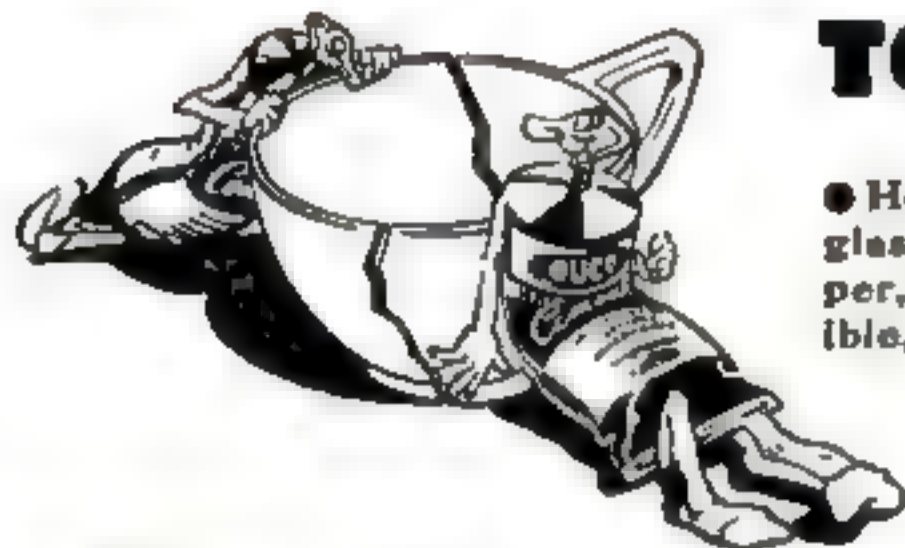
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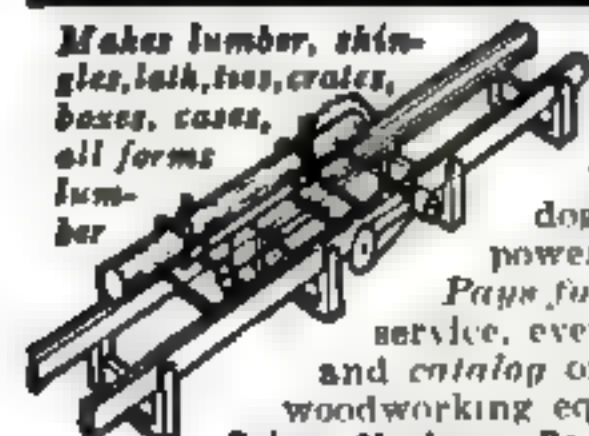
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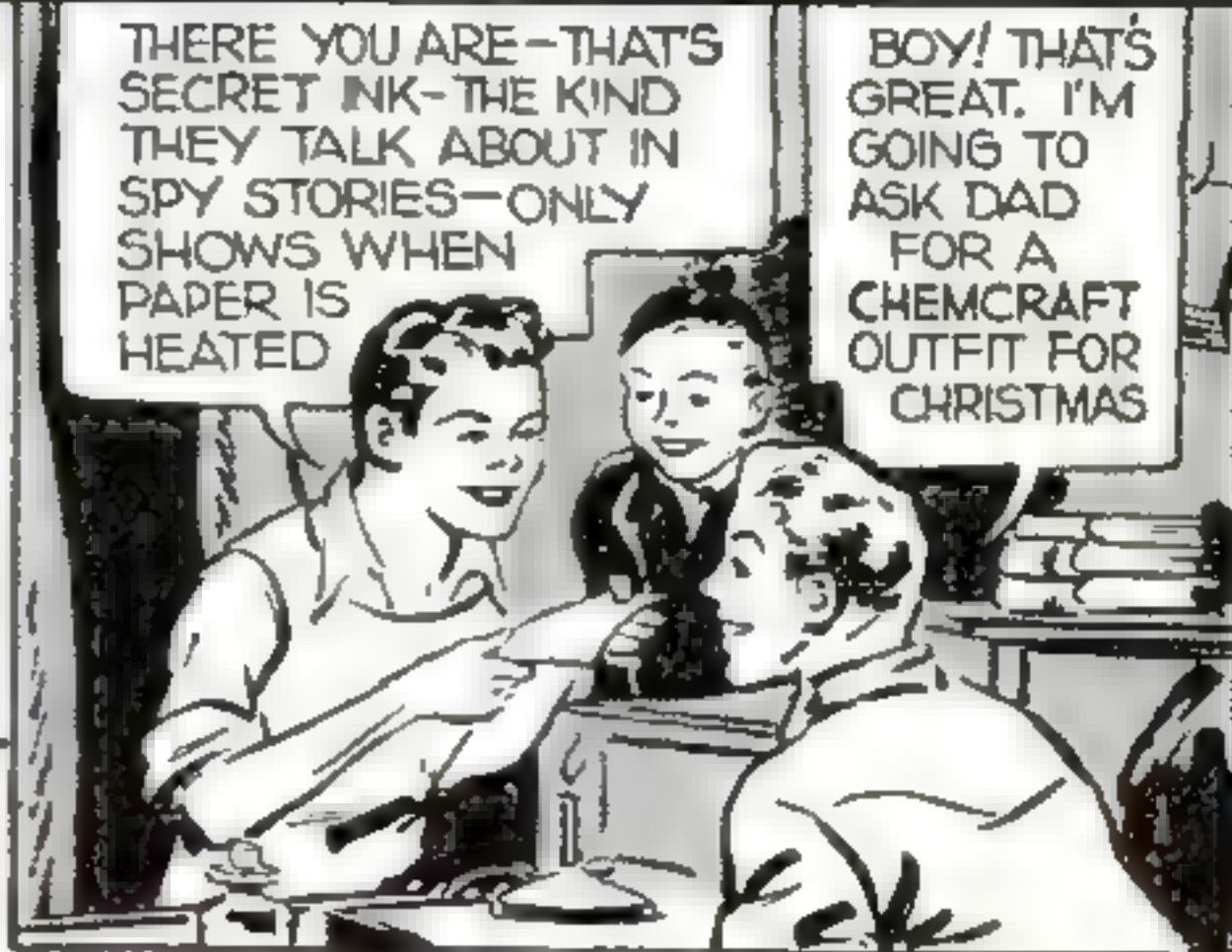
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Life in a Leaf

(Continued from page 223)

any color is covered with numerous, close-set, curving spines. When the petal is of a very dark color, these spines reflect the light in such a way that a velvety effect is produced. In fact, the petal and a piece of velvet are not much different in the matter of surface texture. A light-colored pansy petal does not look velvety, because so much light is reflected by the cells below the epidermis that it blots out the weaker sheen reflected from the spines, whereas in a dark petal most of the light, except that reflected in such a way as to produce the sheen, is absorbed by the cells below.

To observe spines, hairs, and scales from the side, either focus on the edge of the leaf, or fold it sharply with the surface to be observed outward, and focus along the edge of the fold. Of course, you can observe epidermal hairs and other irregularities in cross-sections when the sections happen to include them. Still another way is to scrape the spines off the leaf with a razor blade, and put them on a slide for observation.

Such spines, and other plant materials, sometimes are mounted in glycerin for preservation, rather than in balsam, because glycerin does not require complete dehydration. A common routine for tissue is to harden it first for a day or so in some standard fixer such as Carnoy's fluid, Bouin's solution, chrome-acetic acid, or simply a ninety-percent solution of alcohol; then pass it successively through ten, twenty-five, fifty and seventy-five-percent solutions of glycerin in water, and finally into pure glycerin, leaving the specimen twelve hours in each. Another way is to put the specimen in a solution of, say, fifteen-percent glycerin, and set it aside in a dry, dust-free atmosphere for a number of days or weeks, until the water evaporates and leaves it in pure glycerin. Then mount on a slide with the glycerin as a medium.

Whatever the method they use, most microscopists have difficulty keeping a glycerin mount intact over long periods. The usual way of preparing a slide is to place the glycerin and specimen under a cover glass, remove excess liquid with a damp cloth, and then ring the cover with asphalt varnish, shellac, or other suitable cement. A shellac cell is built up on the slide beforehand, if the thickness of the specimen requires it. Although such mounts, when carefully made and stored, will last for years, they are easily damaged by glancing blows and other abuse.

A method of making more rugged mounts in glycerin or other liquids is illustrated on page 223.



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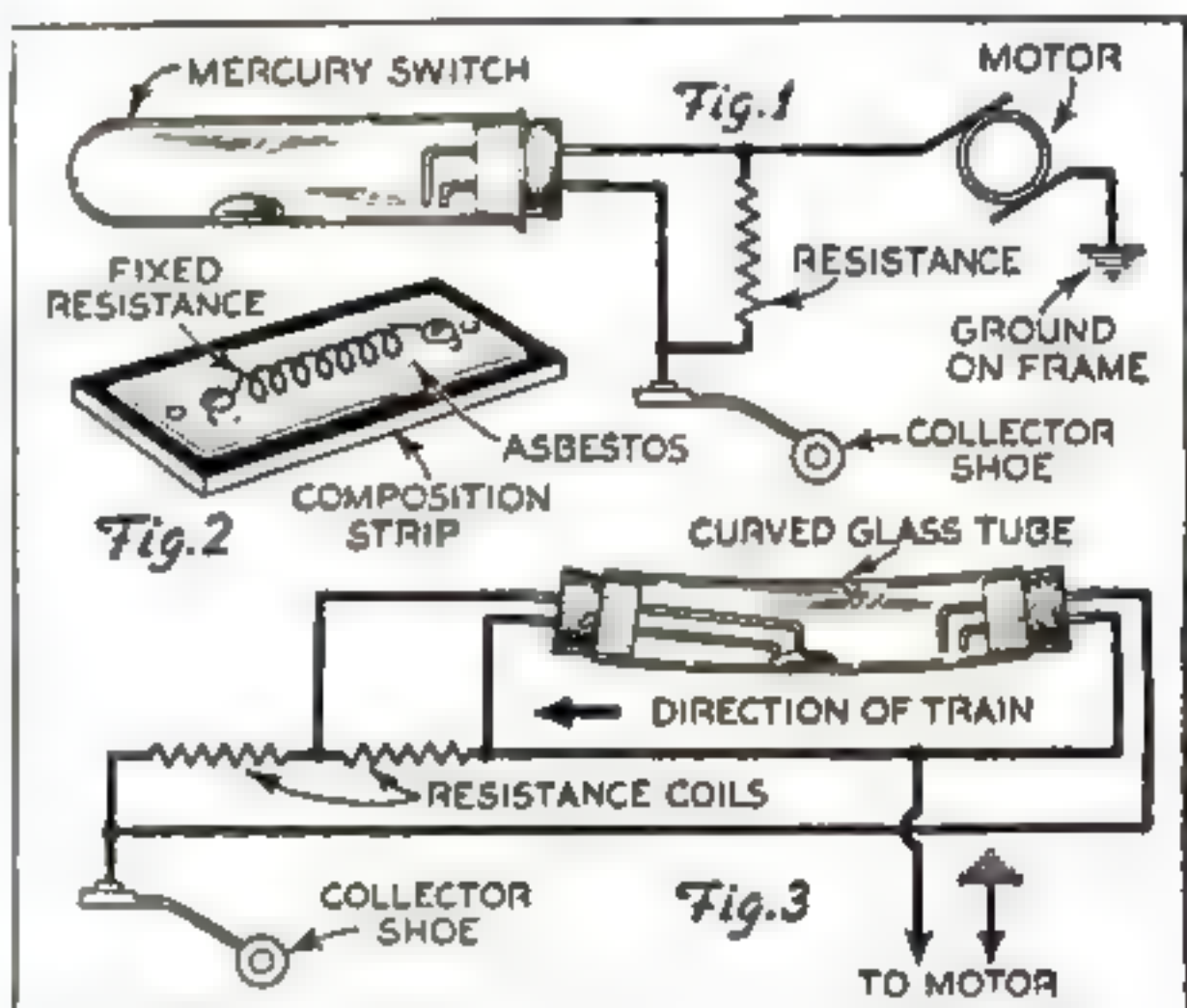
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A length of resistance wire salvaged from a discarded radio rheostat is then mounted



Two types of mercury switches, methods of wiring them, and how the resistance is made

on a composition strip covered with sheet asbestos to prevent overheating during long runs, as in Fig. 2. The length of the wire, found by experiment, should be just sufficient to hold the engine at regular running speed for level stretches of the track when the transformer or track-control rheostat is set high enough to carry the train over the grade. Break the lead wire from the collector shoe to the motor and insert the resistance. The composition strip may be fastened to the motor frame where convenient.

To control the speed of a train on both up and down grades, if that is desired, use a curved tube with corks in each end, as in Fig. 3. One set of contacts reaches to the center of the tube so that the mercury will touch them when the train is on the level. One set is at the rear so they will operate when the train is climbing. Normally, the train runs on one resistance coil. When it goes upgrade, the full current passes directly to the motor; when down, the current is limited by the two resistance coils, which are in series.—EARLE T. ORCHARD.

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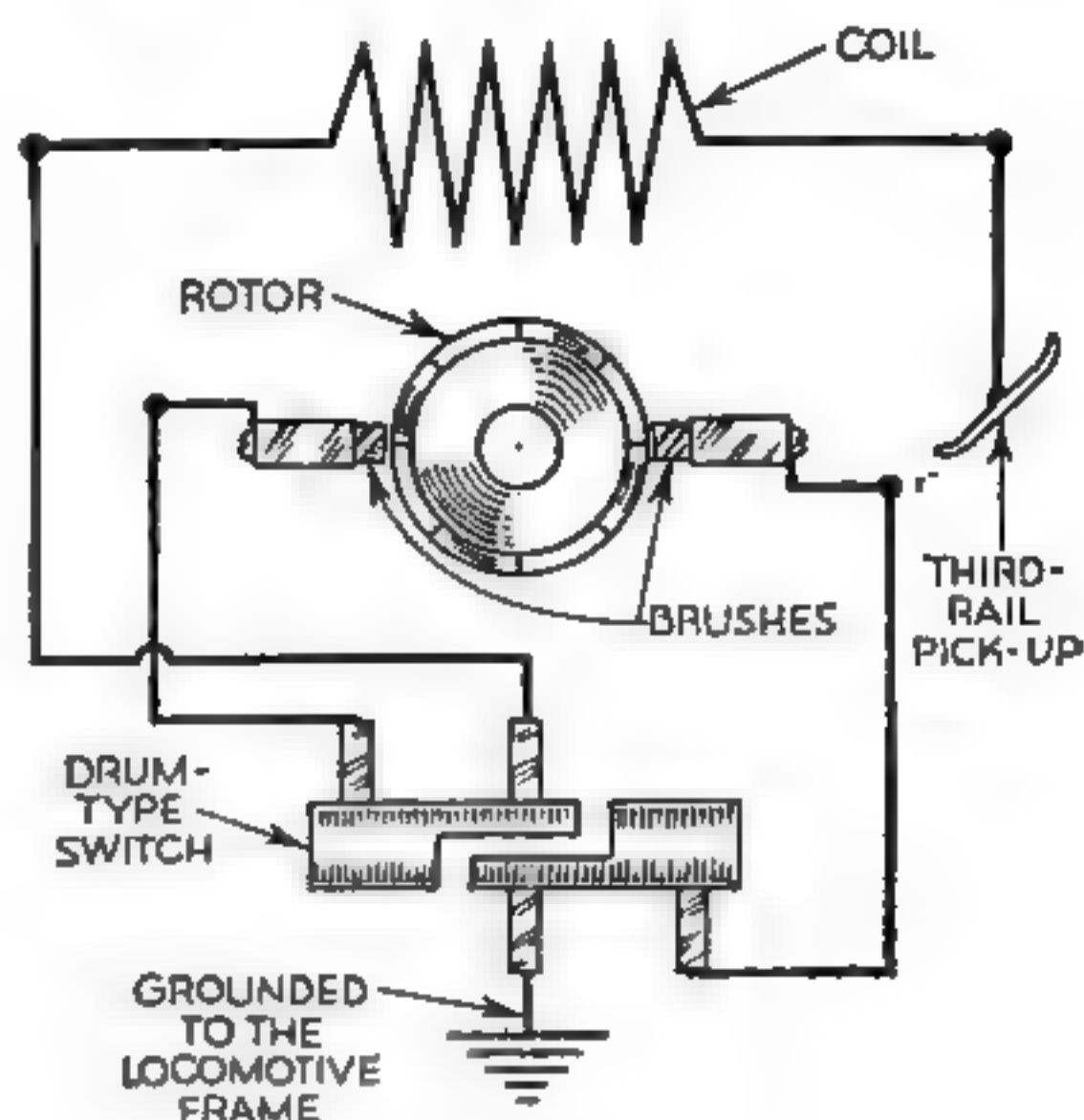
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If you check the motor closely, you will notice that there are four leads—two from the coil and two from the brushes. In order to connect the motor to a reversing switch, it will be necessary to sever all these connections.

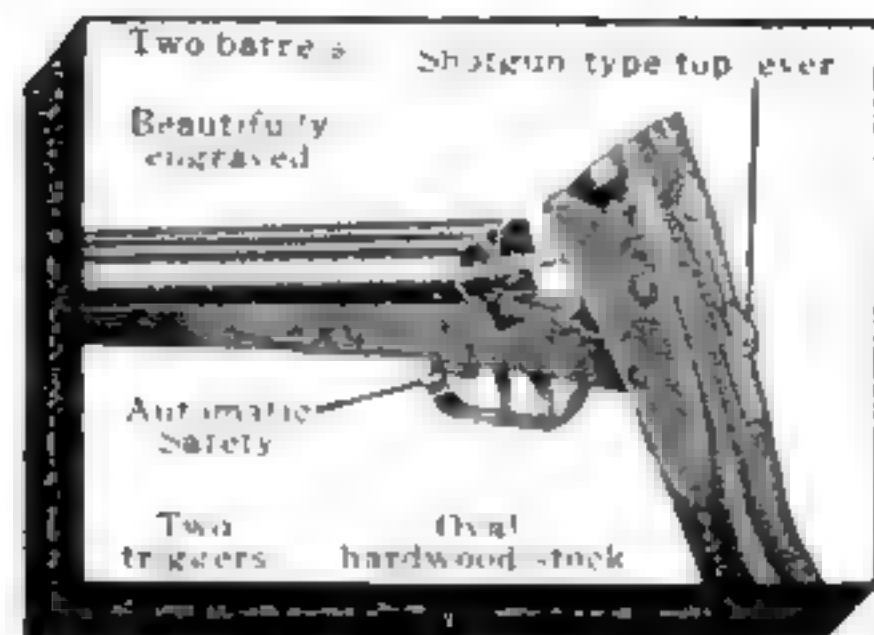
The reversing switch has four terminals. One of these in the center is grounded to the locomotive frame and becomes one of the pick-up leads. One side of the coil is connected to the remaining center terminal of the switch. One brush lead is then connected to each side of the reversing switch as shown in the diagram, which shows a standard drum-type reversing switch sold by all dealers in model railroad supplies. The wiring, however, is typical and can be applied to any type of reversing switch having four terminals.—C. A. V.

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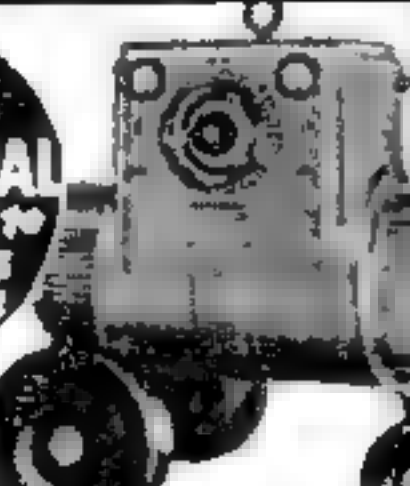
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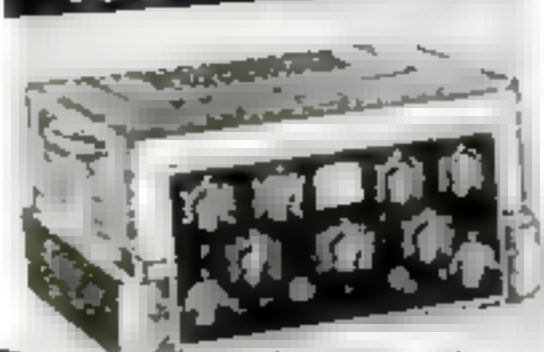
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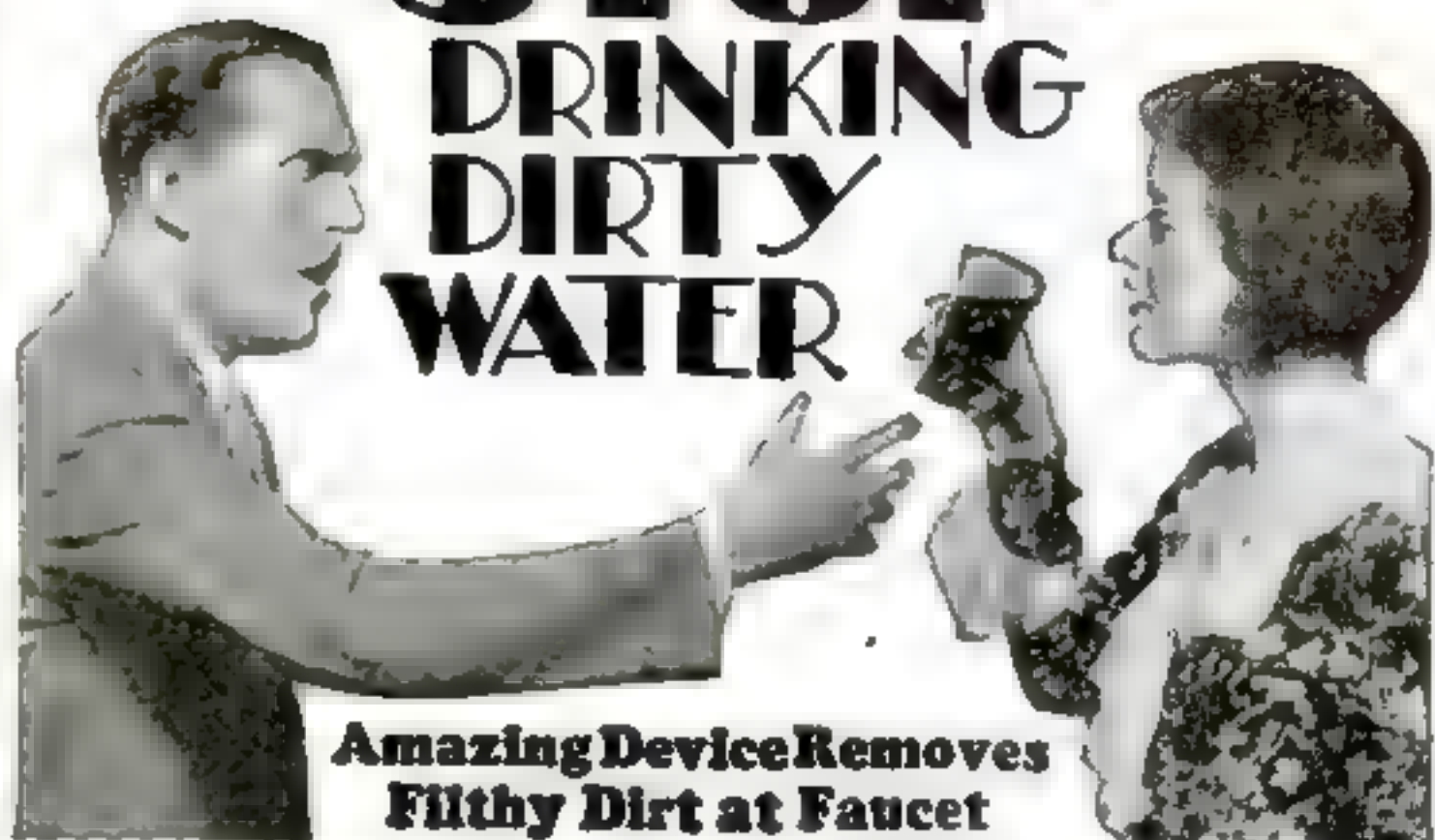
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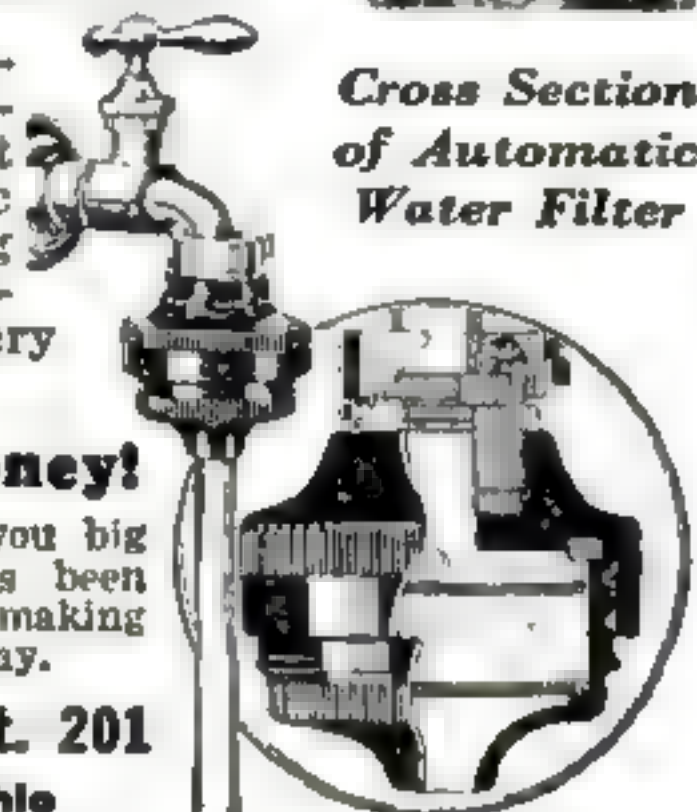
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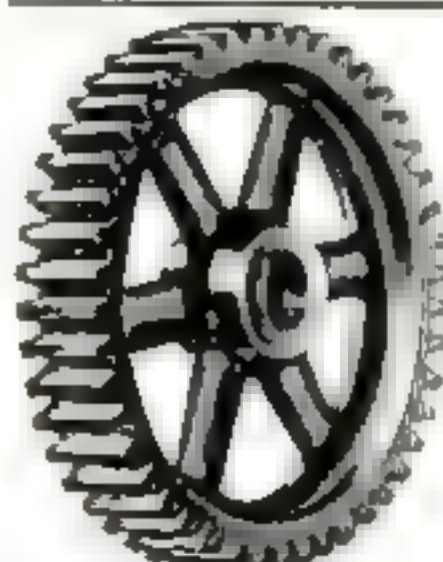
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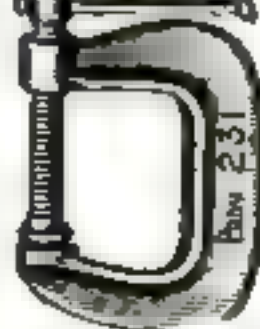
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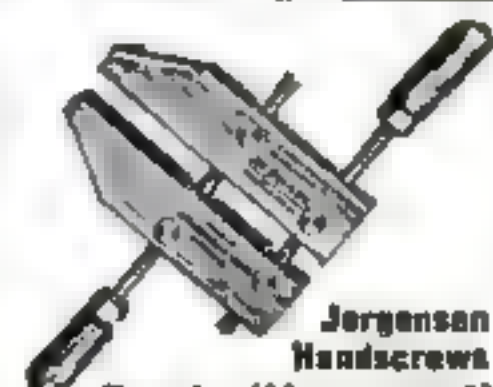
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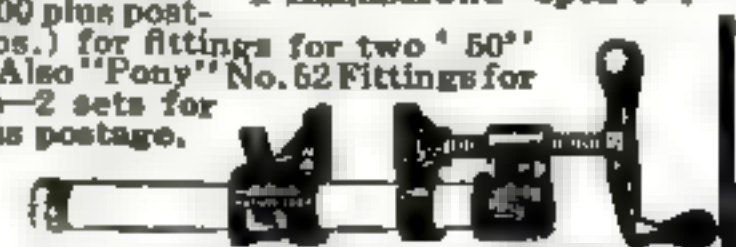
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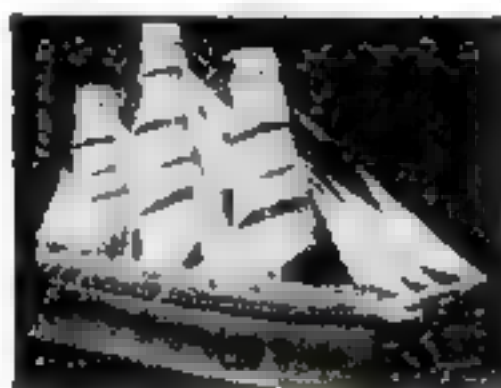
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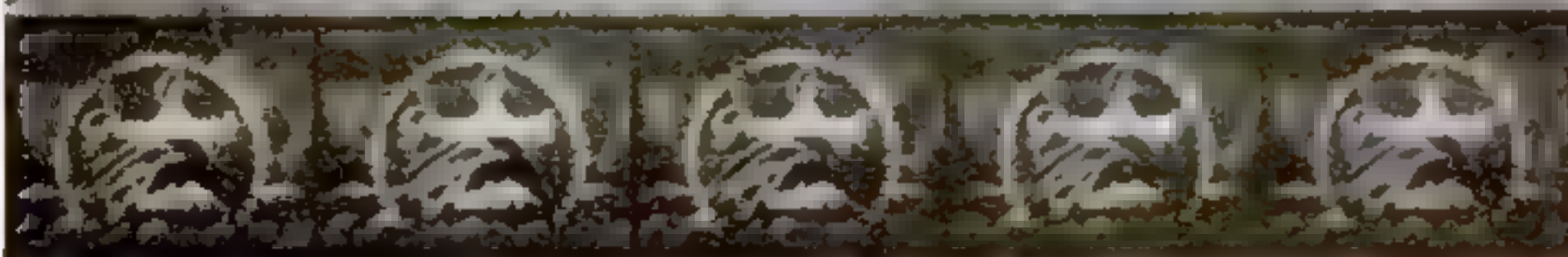
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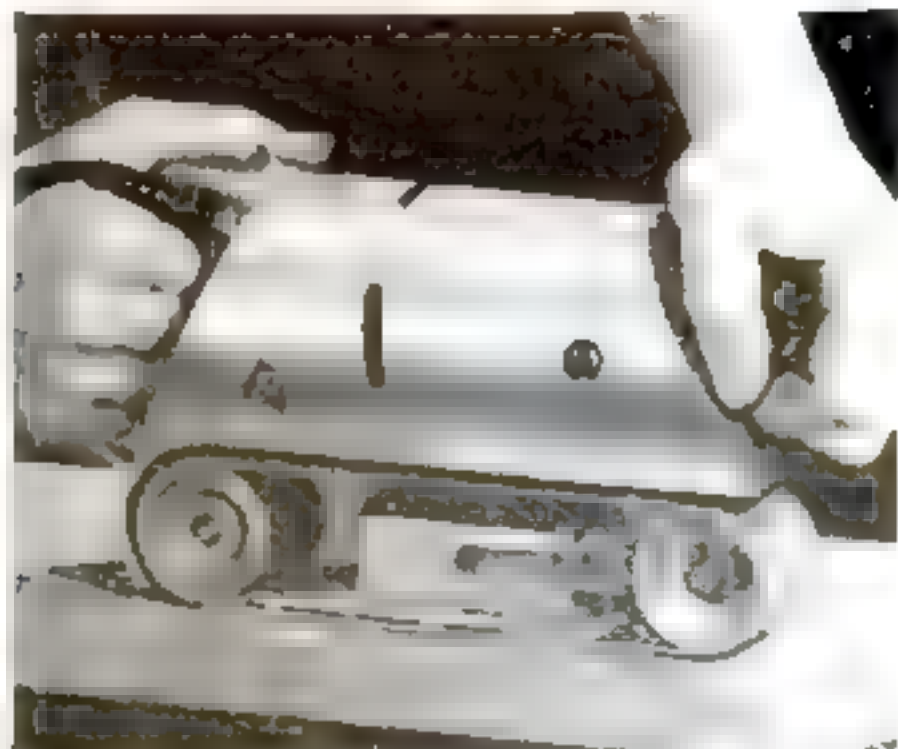
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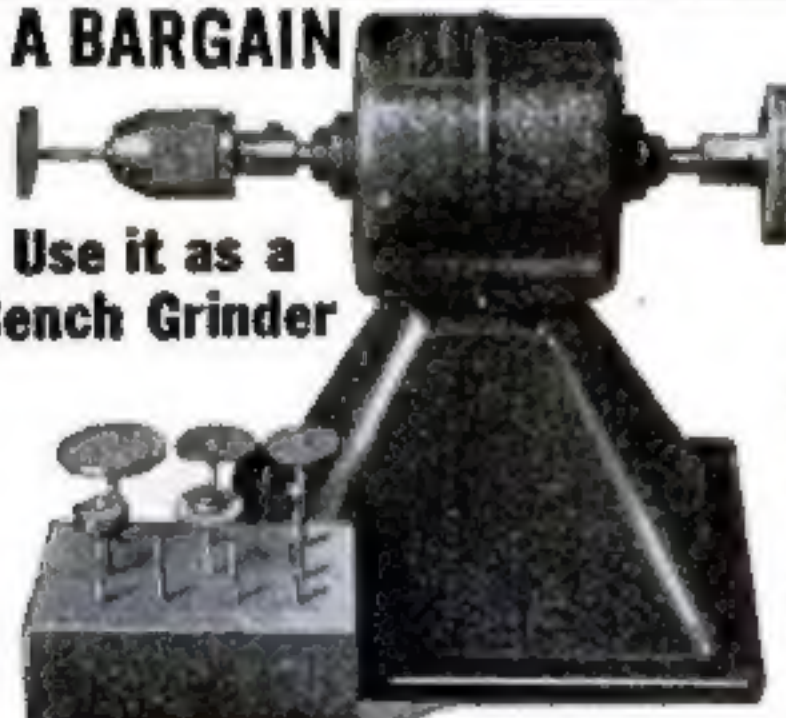
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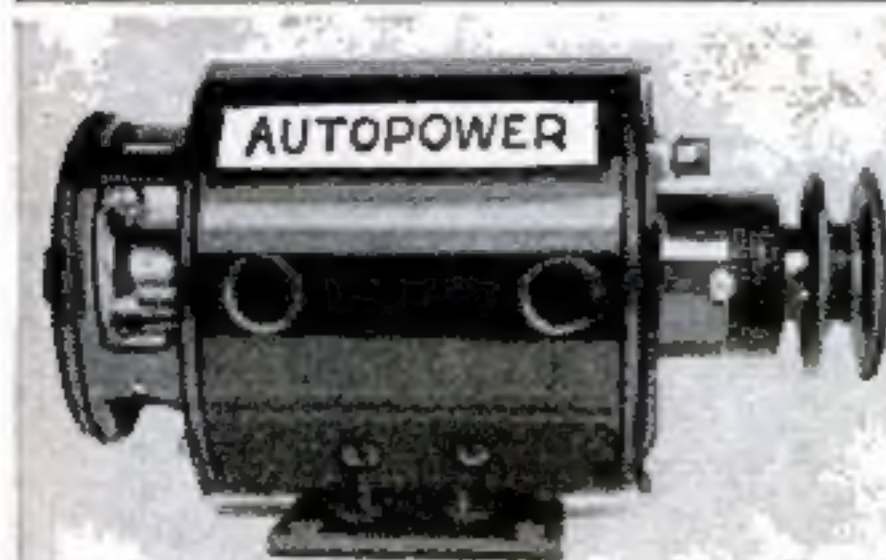
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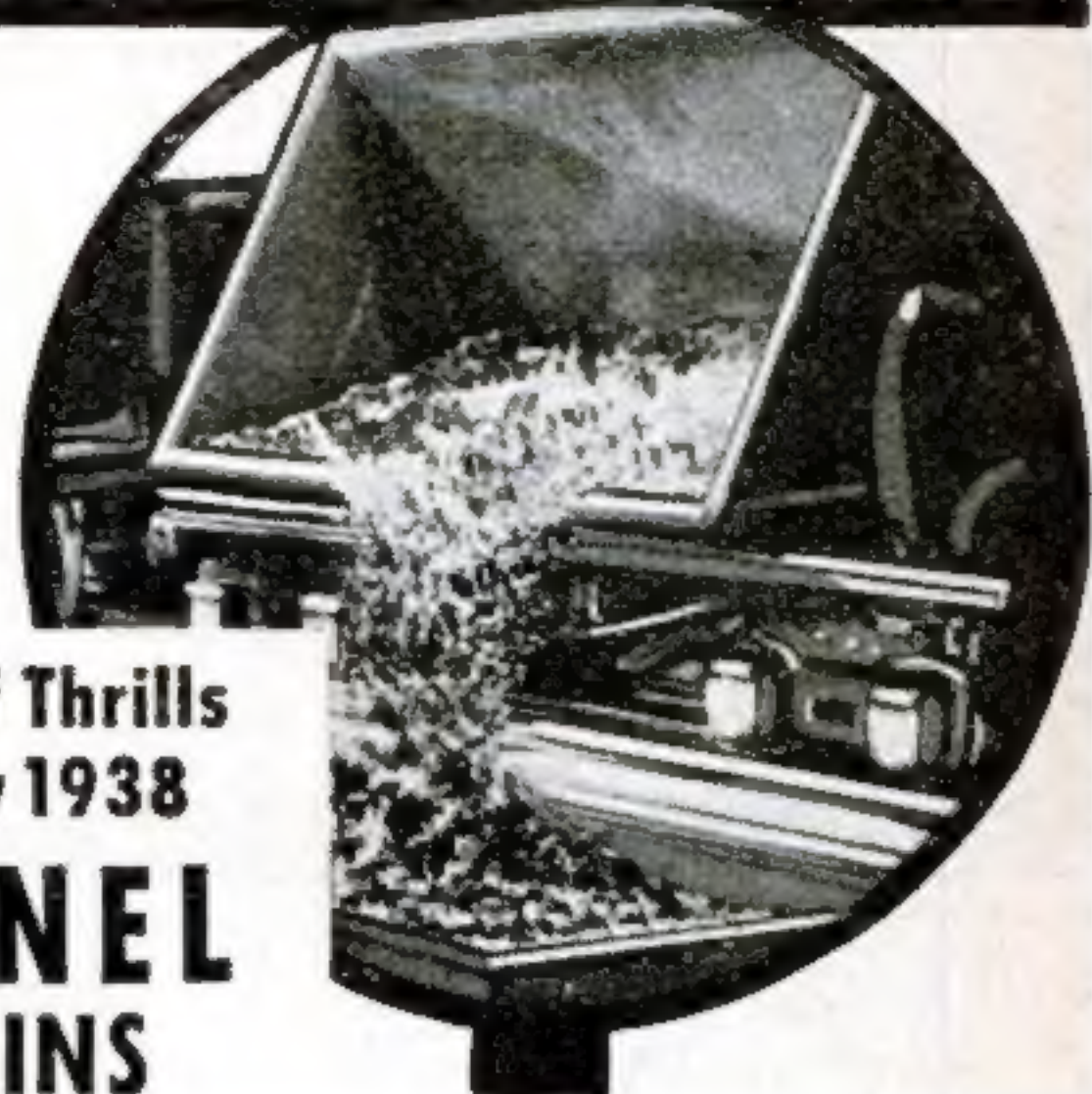
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and so
is he

LIKE humans, dogs have a complicated, highly developed set of nerves. But dogs are kinder to their nerves than we are. They rest when they need rest...while we plunge ahead with our hurry and worry—straining our nerves to keep up with the fast pace. We can't turn back to the natural life of an animal, but we *can* soothe and rest our nerves. Camel cigarettes can be your pleasant reminder to take a helpful breathing spell. Smokers find Camel's costlier tobaccos are mild, delightfully soothing—*soothing*—to the nerves.

Successful people advise
"Let up...*light up a Camel*"

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RALPH GULDAHL (above), U. S. Open golf champion, reveals an "inside" story. "I've learned to ease up now and again—to let up...and light up a Camel. Little breaks in daily nerve tension help to keep a fellow on top. Smoking a Camel is actually *soothing* to my nerves!"



Smoke 6 packs of
Camels and find
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the **LARGEST-
SELLING
CIGARETTE
IN AMERICA**

LET UP—*LIGHT UP A CAMEL!*

Smokers find Camel's Costlier Tobaccos are Soothing to the Nerves